








Bulletin of  
Duke University  
1995-96

Medical Center



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*Medical Center*

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The information in the bulletin applies to the academic year 1995-96 and is accurate and current, to the best of our knowledge, as of February, 1995. The university reserves the right to change programs of study, academic requirements, lecturers, teaching staffs, the announced university calendar, and other matters described in the bulletin without prior notice, in accordance with established procedures.

Information that the university is required to make available under the Student Right to Know and Campus Security Acts may be obtained from the Office of University Relations at 684-2823 or in writing to 615 Chapel Drive, Duke University Durham, NC 27708.



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# School Of Medicine Calendar 1995-96

## First Year (Freshmen) Students Fall Term 1995

<b>August</b>		
9	Wednesday, 8:30 a.m.	- Orientation begins
14	Monday, 8:00 a.m.	- Begin Block I and 1995-96 academic year
<b>October</b>		
5	Thursday, 6:00 p.m.	- End Block I
10	Tuesday, 8:00 a.m.	- Begin Block II
<b>November</b>		
21	Tuesday, 6:00 p.m.	- Begin Thanksgiving holiday
27	Monday, 8:00 a.m.	- Classes resume
<b>December</b>		
15	Friday, 6:00 p.m.	- End Block II and Fall 1995 Term

## Spring Term 1996

<b>January</b>		
8	Tuesday, 8:00 a.m.	- Begin Block III and Spring 1996 Term
15	Monday	- Martin Luther King, Jr. holiday
<b>February</b>		
2	Friday, 6:00 p.m.	- End Block III
5	Monday, 8:00 a.m.	- Begin Block IV
<b>April</b>		
12	Friday, 6:00 p.m.	- End Block IV and begin spring vacation
22	Monday, 8:00 a.m.	- Classes resume. Begin Block V
<b>June</b>		
21	Friday, 12:00 noon	- End Block V and 1995-96 academic year

## Second Year (Sophomore) Students Introduction to Clinical Diagnosis, Summer Term 1995

<b>July</b>		
10	Monday, 8:00 a.m.	- Begin classes
<b>August</b>		
25	Friday, 12:00 noon	- End classes

## Fall Term 1995

### Alternate Schedule for Psychiatry/Cost Effective Care

81 PSC	August 28 - October 6
CEC	October 9 - October 20
82 PSC	October 23 - December 1
CEC	December 4 - December 15

<b>August</b>		
28	Monday, 8:00 a.m.	- Begin classes in sections 81,41
<b>September</b>		
4	Monday	- Labor Day holiday, CEC October 9 - October 20
20	Wednesday, 6:00 p.m.	- End classes in section 41
25	Monday, 8:00 a.m.	- Begin classes in section 42
<b>October</b>		
18	Wednesday, 6:00 p.m.	- End classes in sections 81,42
23	Monday, 8:00 a.m.	- Begin classes in sections 82, 43
<b>November</b>		
15	Wednesday, 6:00 p.m.	- End classes in section 43
20	Monday, 8:00 a.m.	- Begin classes in section 44
22	Wednesday, 6:00 p.m.	- Begin Thanksgiving holiday
27	Monday, 8:00 a.m.	- Resume classes in section 44
<b>December</b>		
16	Saturday, 6:00 p.m.	- End classes in section 82,44



## **Spring Term 1996**

### **Alternative Schedule for Psychiatry/Cost Effective Care**

81 PSC January 8 - February 16

CEC February 19 - March 1

82 PSC March 11 - April 18

CEC April 19 - May 1

#### **January**

- 8 Monday, 8:00 a.m. - Begin classes in sections 81,41
- 15 Monday - Martin Luther King, Jr. holiday
- 31 Wednesday, 6:00 p.m. - End classes in section 41

#### **February**

- 5 Monday, 8:30 a.m. - Begin classes in section 4282 PSC March 11 - April 18
- 28 Wednesday, 6:00 p.m. - End classes in sections 81,42 and begin spring vacation

#### **March**

- 11 Monday, 8:00 a.m. - Begin classes in sections 82,43
- 28 Thursday - Third Year Elective Forms due in dean's office

#### **April**

- 3 Wednesday, 6:00 p.m. - End classes in section 43
- 8 Monday, 8:00 a.m., Begin classes in section 44
- 10 Wednesday - Registration Fall 1996, rising third and fourth year students
- 30 Tuesday, 6:00 p.m. - End classes in sections 82,44. Late registration for Fall 1996

## **Summer Term 1996**

### **Alternative Schedule for Psychiatry/Cost Effective Care**

81 PSC May 7 - June 14

CEC June 17 - June 28

82 PSC July 1 - August 9

CEC August 12 - August 23

#### **May**

- 7 Tuesday, 8:00 a.m. - Begin classes in sections 81,41
- 29 Wednesday, 6:00 p.m. - End classes in section 41

#### **June**

- 3 Monday, 8:00 a.m. - Begin classes in section 42
- 26 Wednesday, 6:00 p.m. - End classes in sections 81,42

#### **July**

- 1 Monday, 8:00 a.m. - Begin classes in sections 82, 43
- 4 Thursday - Independence Day holiday
- 24 Wednesday, 6:00 p.m. - End classes in section 43
- 29 Monday, 8:00 a.m. - Begin classes in section 44

#### **August**

- 21 Wednesday, 6:00 p.m. - End classes in sections 82,44

## **Third Year (Junior) and Fourth Year (Senior) Students**

### **Summer Term 1995**

#### **May**

- 2 Tuesday, 8:00 a.m. - Begin classes in sections 16,81,41
- 27 Saturday, 12:00 noon - End classes in section 41
- 29 Monday, 8:00 a.m. - Begin classes in section 42

#### **June**

- 24 Saturday, 12:00 noon - End classes in sections 81,42
- 26 Monday, 8:00 a.m. - Begin classes in sections 82,43

#### **July**

- 4 Tuesday - Independence Day holiday
- 22 Saturday, 12 noon - End classes in section 43

24	Monday, 8:00 a.m. - Begin classes in section 44
<b>August</b>	
19	Saturday, 12:00 noon - End classes in sections 16,82,44
<b>Fall Term 1995</b>	
<b>August</b>	
28	Monday, 8:00 a.m. - Begin classes in sections 16,81,41
<b>September</b>	
4	Monday, Labor Day holiday
23	Saturday, 12:00 noon - End classes in section 41
25	Monday, 8:00 a.m. - Begin classes in section 42
<b>October</b>	
21	Saturday, 12:00 noon - End classes in sections 81,42
23	Monday, 8:00 a.m. - Begin classes in sections 82,43
<b>November</b>	
8	Wednesday - Registration for Spring Term, 1996
18	Saturday, 12:00 p.m. - End classes in section 43
20	Monday, 8:00 a.m. - Begin classes in section 44
22	Wednesday, 6:00 p.m. - Begin Thanksgiving holiday
27	Monday, 8:00 a.m. - Classes resume in section 44
28	Tuesday - Late registration day for Spring Term, 1996
<b>December</b>	
19	Tuesday, 12:00 noon - End classes in sections 16,82,44
<b>Spring Term 1996</b>	
<b>January</b>	
8	Monday, 8:00 a.m. - Begin classes in sections 16,81,41
15	Monday - Martin Luther King, Jr. holiday
<b>February</b>	
3	Saturday, 12:00 noon - End classes in section 41
5	Monday, 8:00 a.m. - Begin classes in section 42
<b>March</b>	
2	Saturday, 12:00 noon - End classes in sections 81,42. Begin spring vacation
11	Monday, 8:00 a.m. - Begin classes in sections 82,43
20	Tuesday - Registration for Summer Term 1996 - rising fourth year students
28	Thursday - Third Year Elective Forms due in dean's office
<b>April</b>	
6	Saturday, 12:00 noon - End classes in section 43
8	Monday, 8:00 a.m. - Begin classes in section 44
10	Wednesday - Registration for Fall Term 1996 - rising third and fourth year students
30	Tuesday - Late registration day for Fall Term, 1996
<b>May</b>	
4	Saturday, 12:00 noon - End classes in sections 16,82,44
11-12	Saturday-Sunday - Graduation activities
<b>Summer Term 1996</b>	
<b>May</b>	
7	Tuesday, 8:00 a.m. - Begin classes in sections 16,81,41
<b>June</b>	
1	Saturday, 12:00 noon - End classes in section 41
3	Monday, 8:00 a.m. - Begin classes in section 42
29	Saturday, 12:00 noon - End classes in sections 81,42
<b>July</b>	
1	Monday, 8:00 a.m. - Begin classes in sections 82,43
4	Thursday - Independence Day holiday
27	Saturday, 12:00 noon - End classes in section 43
29	Monday, 8:00 a.m. - Begin classes in section 44
<b>August</b>	
24	Saturday, 12:00 noon - End classes in sections 16,82,44

# University Administration

Nannerl Overholser Keohane, Ph.D., *President*

John W. Strohbehn, Ph.D., *Provost*

Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean, School of Medicine*

Charles E. Putman, M.D., *Executive Vice-President for Administration*

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John F. Adcock, B.S., *Vice-President and Corporate Controller*

Leonard C. Beckum, Ph.D., *University Vice-President and Vice-Provost*

Tom A. Butters, B.A., *Vice-President and Director of Athletics*

Janet Smith Dickerson, M.Ed., *Vice-President for Student Affairs*

Joseph S. Beyel, M.S., *Vice-Chancellor and Chief Financial Officer for Medical Center Development*

William J. Donelan, B.A., M.S., *Vice-Chancellor and Chief Financial Officer for Medical Center Administration*

Gordon G. Hammes, Ph.D., *Vice-Chancellor for Medical Center Academic Affairs*

Mark C. Rogers, M.D., *Vice-Chancellor for Health Services and Executive Director for Duke Hospital*

R. C. Bucky Waters, B.S., M.A., *Vice-Chancellor for Special Projects, Duke University Medical Center*

David B. Adcock, J.D., *University Counsel*

N. Allison Haltom, A.B., *Secretary of the University*

William H. Willimon, M.Div., S.T.D., *Dean of the Chapel*

## Medical Center Administration

### Office of Chancellor for Health Affairs

Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean of the School of Medicine*

William J. Donelan, M.B.A., *Vice-Chancellor for Medical Center Administration and Chief Financial Officer*

Gordon G. Hammes, Ph.D., *Vice-Chancellor for Medical Center Academic Affairs*

Raymond C. Waters, M.A., *Vice-Chancellor for Special Projects*

Dan G. Blazer II, M.D., Ph.D., *Dean, Medical Education*

Robert G. Winfree, M.A., *Associate Vice-Chancellor for Health Affairs*

James L. Bennett, Jr., A.B., *Director of Administration*

Bernard McGinty, B.A., *Director of Budget and Finance*

Larry D. Nelson, B.S., *Assistant Vice-Chancellor for Health Affairs, Planning and University Architect*

L. T. Matthews, B.A., *Director of Engineering and Operations*

J. Michael Gower, M.B.A., *Director of Financial Planning and Systems*

Vicki Y. Saito, B.F.A., *Assistant Vice-Chancellor for Health Affairs, Communications*

Steven G. Sloate, M.B.A., *Associate Vice-Chancellor for Health Affairs, Planning*

Barbara E. Echols, J.D., M.B.A., *Assistant Vice-Chancellor for Medical Center Academic Affairs*

Joseph S. Beyel, M.S., *Vice-Chancellor for Health Affairs, Development and Alumni Affairs*

### Office of Medical and Allied Health Education

Dan G. Blazer II, M.D., Ph.D., *Dean, Medical Education*

Emil R. Petrusa, Jr., Ph.D., *Medical Center Registrar, Associate Dean, Medical Education*

Lois A. Pounds, M.D., *Associate Dean, Medical Education-Admissions*

Jeffrey R. Dawson, Ph.D., *Associate Dean, Medical Education-Curriculum*

Elizabeth Rogers, M.D., *Associate Dean, Medical Education-Curriculum*

Daniel T. Gianturco, M.D., *Associate Dean, Medical Education*

Deborah W. Kredich, M.D., *Associate Dean, Medical Education*

Andrew C. Puckett, Jr., Ph.D., *Associate Dean, Medical Education*

Barbara Sheline, M.D., M.P.H., *Assistant Dean, Undergraduate Primary Care Education*

John L. Weinerth, M.D., *Associate Dean, Graduate Medical Education*

Thomas E. Sibert, M.D., *Associate Dean, Continuing Medical Education and Director, Duke Area Health Education Center*

Gerald Strand, Ph.D., *Adjunct Assistant Dean, and Director, Fayetteville Area Health Education Center*

### Office of Duke University Hospitals

Mark C. Rogers, M.D., *Vice Chancellor, Executive Director and Chief Executive Officer*

Michael D. Israel, M.P.H., *Chief Operating Officer, Duke University Hospital*

Paul M. Rosenberg, J.D., *Chief Operating Officer, Duke Hospital South*

John Robinette, M.H.A., *Associate Chief Operating Officer, Duke University Hospital*

Brenda Nevidjon, B.S.N., M.S., *Associate Chief Operating Officer for Nursing*



Roger Akers, B.S., *Controller, Duke Hospital*  
John L. Weinerth, M.D., *Director, Graduate Medical Education*  
David C. Sabiston, M.D., *Chief of Staff*

## **Office of the School of Nursing**

Mary T. Champagne, R.N., Ph.D., *Dean*  
Barbara S. Turner, D.N.Sc., R.N. F.A.A.N., *Associate Dean*  
W. C. Budzinski, *Administrative Manager*  
Maureen Shanley, *Admissions Manager*  
Leesa Atkins, *Staff Assistant*

# **Standing Committees of the School of Medicine and Medical Center**

## **Admissions Medical School**

Lois A. Pounds, M.D., *Chairman*; Drs. Abou-Donia, W. B. Anderson, Bradford, C. E. Buckley III, Casseday, S. Counce, Denniston, Drucker, Epstein, Farmer, Fortney, Frothingham, Hage, Hamilton, Hanson, Haynes, Hertzberg, Hudson, Kudler, McLendon, Massey, A. Meyer, Mitchell, J. Murray, Robboy, Rourk, Sabiston, Schanberg, Thraikill, C. Young, and W. G. Young; Administrative Assistant; Ms. Franklin; Student Representatives: Messrs. Horowitz, Mansbach, Hare, Rothman; Ms. McGuire, and Pradhan

## **Animal Care and Use Committee**

Bruce Leone, M.D., *Chairman*, Drs. Canada, Kaufman, McCarty, Hawkins, Williams, Rahija; Mr. Rodio - *Administrative Director*, Hawk, Blankenship-Paris, Krangel, Gustafson, McCaughan, Hershfield, Feldman, Linney, Skene, Fitzpatrick, Saling, Schomberg, O'Brien, Klintworth, Steenberg, Reimer, Friedman, P. Anderson, Abou-Donia, Mills, Feeser, Bissette, Levin, C. Erickson, R. Erickson, Glower, Lyerly, Crenshaw, McClay, Bonventura, Kirby-Smith, Guehery, Ferrell, Argon

## **Audit and Tissue**

Clinical chairman of each clinical service and head of each division in service

## **Basic Science Appointments, Promotion, and Tenure**

Robert Webster, Ph.D., *Chairman*; Drs. Hammes, Hylander, McClay, McIntosh, Modrich, Nadler, and Simon

## **Basic Science Faculty Steering**

Drs. L. Davis, J. Dawson, Graham, B. Hall, Kreuzer, McIntosh, Maas, Schwartz, and Swenson

## **Brain Death**

Allen D. Roses, M.D., *Chairman*; Neurology—Drs. Alberts, Albright, Clark, Davis, DeLong, Earl, Erwin, Glantz, Goldstein, Hosford, Hurwitz, Lewis, McNamara, E. W. Massey, J. Massey, Radtke, Rosenfield, Rozear, Sanders, Schmechel, Shin, Tourian, and Vance; Neurosurgery—Drs. Cook, Friedman, Turner, and Wilkins

## **Clinical Cancer Education Program**

John M. Falletta, M.D., *Chairman and Director*; Dr. Halperin

## **Clinical Sciences Appointments, Promotions, and Tenure**

Carl Ravin, M.D. *Chairman*; Drs. Blazer, Epstein, Fridovich, Frances, Kurtzberg, and Pizzo

## **Clinical Sciences Faculty Council on Academic Affairs**

Drs. Akwari, Berchuck, Brazier, Coleman, Copeland, Falletta, Fulkerson, George, Georgiade, Gottfried, Hage, Halperin, Jaffe, Meyer, and Wigfall; N. Allen, *ex-officio*

## **Continuing Medical Education**

Thomas Sibert, M.D. *Chairman*; Ms. Easterling, *Director*; Drs. Bennett, Cohen, Drecker, Frazier, Kenan, O'Connor, and Shields

Executive Committee for Undergraduate Medical Education: Dan G. Blazer II, M.D., Ph.D., *Chairman*; Drs. Dawson, Garson, Halperin, Hammes, Kredich, McIntosh, Nevins, Petrusa, Prosnitz, E. Rogers, Sheline, Snyderman; Student Representative: R. Rothman

## **Dean's Committee on Minority Affairs**

Joanne A. P. Wilson, M.D., *Chairman*; Drs. Carter, Falletta, Gilliam, Harrell, Porter, and Putman; Ms. Johnson; Mr. Adamson

## **Duke Comprehensive Cancer Center Clinical Cancer Committee**

Drs. Bossen, Clarke-Pearson, Falletta, George, Kaufman, Paulson, Prosnitz, Rosse, Seigler, and Trump; Ms. Gilbert, Howard, King, Robertson, Singletary, and Woods; Dr. Bell, *ex officio*

## **Emergency Center Advisory**

Harold R. Silberman, M.D. and Delford L. Stickel, MD., *Cochairmen*; Drs. Addison, Eisenson, Jackson, Maus, Nunnley, Rose, Vandemark, and Wong; Ms. Calhoun, Ford, Groves, Riddle, Wallace, and Weber; Messrs. Hawkins, Richards, Toffaletti, Wallace, C., and Wallace, R.

## **Executive Committee of the Medical Staff**

David C. Sabiston, Jr., M.D., *Chairman*; Drs. Snyderman, R. Anderson, Blazer, Epstein, Frank, Frances, Greenfield, Hammond, Michener, Pizzo, Prosnitz, Ravin, Reves and Rogers

## **Financial Aid**

Ms. Nell Andrews, *Administrator*; Drs. Blazer, Johnston, and Pounds; Ms. Franklin; Mr. McGinty; Student representatives: Mr. Pande; Ms. M. Srinivasan; and three OSR representatives

## **Hospital Ethics**

Jim Travis, Ph.D., *Chairman*; Jane Castle, R.N., M.S.N.; Bill Floyd, M.D. Ricki Goldstein, M. D.; Andy Puckett, Ph.D.; Peter Kussin, M.D. *Co-Chairmen*; Drs. Dell, Foltz, Frank, Friedman, Falletta, Galanos, Gianturco, Goldstein, B. Jones, Kenan, Margolis, McGrath, McIntyre, Moore, Schwinn, Shulman, Stickel, Sugerman, Silberman; Ms. Burke, Castle, Crawford, Falvey, Friedman, Howard, Ionescu-Pioggia, B. Kelly, London, Meadows, Neyland, Thalman, Wicker, and Mr. Ciompi

## **Hospital Infections**

Daniel J. Sexton, M.D., *Chairman*; Drs. Eisenson, Hamilton, Harrell, Hunt, Iglehart, Jackson, Klein, Livengood, Reller, Rudd, Thomann, Weitzner, Wilfert, and Wilson; Ms. Avery, Dorroh, Gardner, Robins, Weddle, and Yova; Messrs. McAllister, Bartlett, and Richards

## **Hospital Transfusion Committee**

John M. Falletta, M.D., *Chairman*; Drs. Addison, Bredehoeft, Cooper, Hall, Kinney, Murray, Rosse, Telen, and Young; Ms. Abernathy and Rodio; Messrs. Barbieri, Bennett, and Stinson

## **Institutional Committee for Graduate Medical Education**

John L. Weinerth, M.D., *Chairman*; Drs. Acker, T. Anderson, Andolsek, Bachus, Blazer, Bradford, Capehart, Cavenar, Copeland, Ferrone, Foltz, Fortney, Goldner, Guice, Grady, L. Gutman, R. Gutman, R. Hall, Hardaker, Hosford, Howell, Keith, Kahler, Katz, King, Kinney, Levin, Lineberger, Lyerly, Madden, Mannon, Pollock, Puckett, Shaddock, Silberman, Stenzel, Timmons, Washington, Whyte; Mr. Ciompi; Ms. Fitzpatrick, Hendrix, and Tuck

## **Institutional Review Board for Clinical Investigations**

John M. Falletta, M.D., *Chairman*, Joseph Farmer, M.D., *Vice Chairman*, Barbara Echols, *Co-chairperson*, Drs. Steele, Ross, Patterson, Ross, Gautier, Perry, Gustafson, Sigman-Hendricks, Mark, Matchar, Olise, Ohman, Turner, Hawthorne, Kay, Walmer, Fowler, Damji, Proia, Bentley, Goldstein, Kessler, Womack, Gwyer, Sparrow, Erwin, McCaskill, Carson, Brizel, Anscher, Carroll, Patz, J. Smith, Myers, Semans, Hover, Rawlings, Guehery, Roycroft; Student Representatives: Howard, Petti and Della Rocca

## **Institutional Biosafety Committee**

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## **Library**

Ms. Susan Feinglos, *Chairman*; Dr. Blazer; Messrs. Winfree and McGinty

## **Medical Center Information Systems Advisory**

Landen Bain, *Chairman*; Drs. Carter, E. Hammond, and Peter Smith



### **Medical Radiation Control and Radioactive Drug Research Committee**

Kenneth W. Lyles, M.D., *Chairman*; Drs. Briner, Grant, Harris, Sullivan, and Wolbarsht; Messrs. Bennett and Knight

### **Medical Center Safety**

Wayne R. Thomann, Ph.D., *Chairman*; Drs. Bradford, Burdette, Harris, Jackson; Messrs. Bowman, Hilliard, Leathers, Rodio, Stinson; Ms. Brady, and Burgess

### **Medical Records**

George J. Ellis III, M.D., *Chairman*; Drs. Gerber, Piscitelli, Stickel and Wang; Ms. Harris, Mears, Woodlief, Worsley, and Yarberry; Messrs. Eubanks, Hunt, Kulik, Moore, and Stinson

### **Medical Center Policy Advisory Committee**

Ralph Snyderman, M.D., *Chairman*; Drs. R. Anderson, Bast, Bell, Blazer, Champagne, Epstein, Frances, Frank, Greenfield, Hammes, Hammond, Kay, Keene, Means, Michener, Nevins, Parkerson, Pizzo, Prosnitz, Purves, Ravin, Raetz, Reves, Rogers, Sabiston, Sheetz, and Tedder; Messrs. Bennett, Donelan

### **Medical Student Research Scholarship**

Galen S. Wagner, M.D., *Chairman*; Drs. Anderson, Bastia, Kaufman, N. Kredich, Lowe, Mills, Pizzo, Reedy, and Williams

### **Merit Awards**

Dan G. Blazer II, M.D., Ph.D., *Chairman*; Drs. Bollinger, N. Kredich, Pounds, and Joanne Wilson; Administrative Assistant: Ms. Franklin; Two student representatives

### **Minority Affairs Committee for Undergraduate Medical Education**

Brenda E. Armstrong, M.D., *Chairman*; Drs. Akwari, Allen, Coyne-Beasley, Grady, Grant, Wigfall; Mr. Sue; Ms. Coviello; Dan Blazer, M.D., Ph.D., *ex officio*



## **North Carolina Residence**

Lois A. Pounds, M.D., *Chairman*; Dr. Clapp; Ms. Konczal

## **Operating Room Advisory**

John Robinette, *Coordinator*; Drs. Anderson, Hammond, Reves, and Sabiston; Ms. Owins; Mr. Brown

## **Pharmacy and Therapeutics**

Eugene W. St. Clair, M.D., *Chairman*; Drs. Cobo, Gianturco, Killam, Kurtzberg, Leight, Rudd, and Weingold; Ms. Miller; Messrs. Dedrick, McAllister, and Robinette

## **Primary Care Committee for Undergraduate Medical Education**

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## **Research Award**

Madison S. Spach, M.D., *Chairman*; Drs. Fridovich, George, Pizzo, Schanberg, and Semans

## **Senior Scholarships**

Drs. Falletta, Grady, Kussin, Tripp, Schwartz, Ms. Konczal

## **Study Away**

Deborah W. Kredich, M.D., *Chairman*; Drs. Garrett, Neelon, Pounds, and Wilfert; Ms. B. Gentry

## **Undergraduate Medical Education – Curriculum**

Tom McIntosh, Ph.D., *Chairman*; Edward Halperin, M.D. *Co-Chairman*; Drs. N. Anderson, Bradford, Cant, Corless, Dawson, Drucker, Ellinwood, Fitzpatrick, Garson, Gianturco, Hage, Haynes, Hoffman, Hylander, A. Johnson, V. Johnson, D. Kredich, Kuhn, LaMantia, Lyerly, McElhaney, Michener, Mitchell, Morgenlander, Nadler, Neelon, Nevins, S. Osterhout, Padilla, Petrusa, Pounds, Puckett, Rajagopalan, Reimer, E. Rogers, Sheline, P. Smith, Steenbergen, Strauss, Vigna, Ward, Wilkinson, Wong; Student Representatives: Dugas, Recchia; Drs. Blazer, Fullagar, Hammes, L. Lee, and Snyderman, Ms. Feinglos, Konczal, Reilly, *ex-officio*

## **Utilization Review**

Harold R. Silberman, M.D., *Acting Chairman*; Drs. Baker, Barwick, Buckley, Burch, Gianturco, McCann, Mitchell, Murray, Rourk, and Young; Ms. Blackwell, Chitty, Davis, Dunn, Fitzpatrick, Long, Marlo, Minnich, R. Moore, P. Penderman, P. Perry, Rowland, Shackleford, Smith; Messrs. Barnes and R. Moore

## **Veterans Administration Research and Development**

Wilkie A. Wilson, Jr., Ph.D., *Chairman*; Drs. Carson, Cowper, Crain, Hamilton, Kudler, Levenson, Pappas, and Patrick; Ms. Henderson and McLees. *Ex-officio*: Drs. Newcomb and Shelburne; Ms. Small; Mr. Duncan

## **Chancellor's Veterans Administration**

Ralph Snyderman, M.D., *Chairman*; Joseph Greenfield, M.D., *Vice-Chairman*; Drs. R. Anderson, Cavenar, Cohen, Epstein, Feussner, Frances, Grant, Newcomb, Pizzo, Prosnitz, Ravin, Reves, Rotman, Scott, Thompson, and Yarger; Ms. Small and Ms. Bumgarten

*General Information*

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## History

I have selected Duke University as one of the principal objects of this trust because I recognize that education, when conducted along sane and practical, as opposed to dogmatic and theoretical, lines is, next to religion, the greatest civilizing influence.

I have selected hospitals as another of the principal objects of this trust because I recognize that they have become indispensable institutions, not only by way of ministering to the comfort of the sick, but in increasing the efficiency of mankind and prolonging human life.

*James Buchanan Duke, Indenture of the Duke Endowment, 1924*

In 1924, James Buchanan Duke, an industrialist and philanthropist, established the Duke Endowment and directed that part of his gift be used to transform Trinity College in Durham, N.C., into Duke University. The following year, upon his death, Duke made an additional bequest to the Endowment and the university, including funds to establish the School of Medicine, the School of Nursing, and Duke University Hospital.

One of the Duke's primary motivations in establishing the Endowment and the School of Medicine was the improvement of health care in the Carolinas and across the country. At a time when medicine in the Carolinas was still a cottage industry, Duke dared to dream of creating what he hoped would become one of the leading medical institutions in the nation.

By the time the new school and hospital opened in 1930, this dream was already well on its way to becoming reality. Recognizing its responsibility for providing quality care to the people of the Carolinas, Duke opened the first major outpatient clinics in the region in 1930. The Private Diagnostic Clinic, organized in 1932, not only provided coordinated medical and surgical care to private patients with moderate incomes but also allowed members of the medical faculty to contribute a portion of their earnings toward the continued excellence of medicine at Duke. Less than five years after the School of Medicine opened, the Association of American Medical Colleges ranked it among the top 25 percent of medical schools in the country.

Building on this heritage, Duke University Medical Center has grown and expanded over the years and now ranks as one of the world's outstanding health care centers. In education, its innovative medical curriculum features a generous measure of elective courses in the belief that all health professionals must be prepared for a lifetime of self education. The scientific grounding for that education is provided through participation in a wide variety of ongoing research programs. Now located in facilities opened in 1980 and since expanded several times, Duke University Hospital draws patients from across the Carolinas, the Southeast and much of the United States for diagnosis and treatment. In both basic and clinical research, Duke University Medical Center has grown into a premier biomedical research institution and is consistently one of the largest recipients of funding from the National Institutes of Health.

Representing the continuing fulfillment of the dream of James Buchanan Duke, Duke University Medical Center still seeks to carry out its teaching, research, and patient care programs in a manner that meets the needs of society. In keeping with its heritage, it seeks to provide socially relevant medical education, research, and patient care and is expressly committed to the search for solutions to regional and national health care problems.

## Medical Center Buildings and Facilities

The eighty-six buildings and additions which make up the medical education, research and patient care facilities are located on approximately 200 acres on the West Campus. The southern quadrant is contiguous with the main quadrangle of the university and consists of the following: *Duke Clinic and Medical School Complex*—nine build-



ings, including: *Davison Building*—Department of Pathology administration, research laboratories and offices, Central Teaching Facility, Division of Audiovisual Education, Medical Center administration, School of Medicine and Office of Admissions. *Original Hospital, 1940 and 1957 Additions*—Rehabilitation inpatient care unit, clinics, diagnostic, treatment and support services including: clinical laboratories, physical therapy, pharmacy, departmental offices, amphitheater and chapel. *Baker House*—Department of Obstetrics and Gynecology administration, clinics, diagnostic, treatment and support services including: speech and hearing, dentistry/oral surgery, pastoral care and counseling, and departmental offices. *Barnes Woodhall Building*—Psychiatry inpatient care units, diagnostic, treatment and support services including: radiology, departmental research laboratories and offices, and Hospital administration. *Diagnostic and Treatment Building*—Clinics, diagnostic, treatment and support services, departmental research laboratories and offices. *Ewald W. Busse Building*—Center for the Study of Aging and Human Development, diagnostic, treatment and support services, departmental research laboratories and offices. *Eugene A. Stead Building*—Clinical Research Unit (Rankin), departmental research laboratories and offices. *Clinical Research II*—Department of Psychiatry administration, departmental research laboratories and offices, hyperbaric medicine unit. *Edwin A. Morris Clinical Cancer Research Building*—Clinics, diagnostic, treatment and support services, Department of Radiation Oncology administration, departmental research laboratories and offices.

The northern quadrant consists of the following: *Joseph and Kathleen Bryan Research Building for Neurobiology*—Department of Neurobiology administration, Alzheimers Disease Research Center, Pharmacology and Neurobiology departmental research laboratories and offices. *Nanaline H. Duke Medical Sciences Building*—Departments of Biochemistry and Cell Biology administration, departmental research laboratories and offices. *Alex H. Sands Medical Sciences Building*—Departments of Anesthesiology, Biological Anthropology and Anatomy, Cell Biology, Obstetrics and Gynecology, and Psychiatry research laboratories and offices. *Edwin L. Jones Basic Cancer Research Building*—Departments of Immunology and Microbiology administration, departmental research laboratories and offices. *Medical Sciences Research Building*—Comprehensive Cancer Center administration, Departments of Medicine, Obstetrics and Gynecology, Pathology, Pediatrics, Radiology, Radiation Oncology, Surgery, and Cancer Center research laboratories and offices. *Clinical and Research Laboratory Building*—Department of Genetics administration, Howard Hughes Medical Institute, Departments of Biochemistry, Cell Biology, Genetics, Medicine, and Psychiatry research laboratories and offices, and hospital clinical laboratories. *Bell Building*—Departments of Medicine, Obstetrics and Gynecology, Pediatrics, Psychiatry, Radiology research laboratories and offices, Medical Center Information Services and the Gross Anatomy laboratories. *Seeley G. Mudd Communication and Library*—Medical Center Library, Office of Communications, Office of Grants and Contracts, Office of Continuing Medical Education, Medical Center Commons and the Searle Center for Continuing Education. *Joseph A. C. Wadsworth Building (Eye Center)*—Clinic, diagnostic, treatment and support services including: operating rooms, recovery, Department of Ophthalmology research laboratories and offices. *Duke Hospital (Anlyan Tower and Ancillary Building)*—Inpatient care units, diagnostic, treatment and support services including: surgical suite, cath labs, emergency department, labor and delivery suite, full term nursery, radiology, laboratories, respiratory therapy, pharmacy, Departments of Anesthesiology, Medicine, Pediatrics, Radiology, and Surgery administration.

The western quadrant consists of the following buildings: *Leon Levine Science Research Center*—Departments of Molecular Cancer Biology and Pharmacology administration, research laboratories and offices. *Surgical Oncology Research Building, Environmental Safety Building, Research Park Buildings I, II, III and IV*—Departments of Anesthesiology, Medicine, Pathology, Pediatrics, Radiology, Radiation Oncology, and Surgery research laboratories and offices and hospital clinical laboratories. *Vivarium*—Division of Laboratory Animal Resources and laboratory animal care facilities. *Cancer*

*Center Isolation Facility*—Special containment facility for cancer research. *Lenox Baker Children's Hospital*—Children's rehabilitation inpatient care unit, clinics, diagnostic, treatment and support services and departmental offices. *Dialysis Center*—Treatment facility. *Center for Living*—Three buildings including: *Sarah Stedman Nutrition Center*—Department of Medicine research laboratories and offices.

*Andrew Wallace Clinic Building*—Clinics, diagnostic, treatment and support services and departmental offices. *Pepsico Fitness Center*—Exercise facilities including indoor track, exercise equipment, and swimming pool.

The eastern quadrant consists of the following buildings: *Marshall Pickens Building*—Clinic, Student Health Service, Employee Health Service, Faculty Family Health Service. *Civitan Building and Child Development Center*—Clinics, laboratories and offices for the Departments of Pediatrics and Psychiatry. *Hanes House and Nursing School Addition*—Nursing school headquarters, offices, and teaching facilities.

The goal of the Duke University Medical Center is to be a leader in contemporary medicine. This involves maintaining superiority in its four primary functions: unexcelled patient care, dedication to educational programs, national and international distinction in the quality of research, and service to the region.

Growth is identified with deeper involvement in the social aspects of health, the establishment of advanced therapeutic and research facilities, and a medical teaching program that has attracted the attention of educators around the world.

## Resources for Study

**Library.** The Medical Center Library is located in the Seeley G. Mudd Building, midway between the north and south Medical Center campuses.

The Medical Center Library attempts to provide informational services and collections necessary to further educational, research, and clinical activities in the health sciences. The collection of approximately 270,000 volumes and 2,700 current journal subscriptions is freely available for use by Medical Center students and personnel; study accommodations for 500 readers includes extensive provisions for audiovisual and computer-assisted learning. The library also includes the Trent Collection which is unsurpassed in the southeast as a resource for study of the history of medicine. Traditional reference services are supplemented by mediated and self-service access to many computerized databases including MEDLINE and CANCERLIT.

The Medical Center Library is open: Monday-Friday, 8:00 A.M.-midnight; Saturday, 10:00 A.M.-6:00 P.M.; Sunday, 12:00 noon-midnight. Summer and holiday hours are as announced.

Director: Susan J. Feinglos, M.L.S. (McGill, 1972); Associate Director: Patricia L. Thibodeau, M.L.S., M.B.A. (Rhode Island, 1976), Western Carolina University, 1991); Curator, Historical Collections: Suzanne Porter, M.L.S. (Columbia, 1966).

The Medical Center Bookstore offers a wide selection of biomedical textbooks and reference books, as well as an assortment of laboratory and clinical instruments and office supplies. Facilities for browsing in a pleasant atmosphere are available, as are special individualized services. The bookstore is open 8:30 A.M.-5:00 P.M., Monday-Friday, 10:00 A.M.-4:00 P.M. Saturday.

Manager: Renee Million

**Searle Conference Center.** The Searle Conference Center for Continuing Education in the Health Sciences provides elegant accommodations for conferences, symposia, lectures, and meetings to support the continuing education activities of the Medical Center and university. Additionally, banquets, dinners, weddings, receptions, and other private events may be held on a space available basis. Meeting space, audiovisual needs, catering, and assistance with event planning are all provided by the on-site staff. Please call 684-2244.

Director: Michael A. Evans



**Medical Center Commons.** The Medical Center Commons Restaurant is open for fine dining at lunch time, Monday-Friday. Accepting credit cards, IRSs, and reservations (684-5805) the Commons is located in the Searle Conference Center, which is on the ground floor of the Seeley Mudd Building. The restaurant features gourmet salads, homemade soups, carved meats, hot entrees, and weekly specials. Prices from \$5-\$9. Private dining rooms are available, as well as morning, evening, or weekend meeting and catering space. For additional information on these services, please call 684-2244.

**The Thomas D. Kinney Central Teaching Laboratory.** The Thomas D. Kinney Central Teaching Laboratory is located on the fourth floor of Davison Building where it provides laboratory, demonstration, and conference space for all courses taught in the basic sciences, with the exception of gross anatomy. A full-time staff maintains a wide range of equipment and provides supplies and services necessary for the teaching programs in allied health as well as medical education. This enables the academic staff of each department to devote its efforts entirely toward the students.

Six unit laboratories, each accommodating sixteen to eighteen students, are devoted to instruction for the first year. All first year medical students are given space in one of these laboratories for their own work which they maintain for the entire academic year. Small laboratories are interspersed between the six unit laboratories and provide space for large pieces of equipment used in conjunction with exercises conducted in the unit laboratories. One large multipurpose laboratory (which can accommodate forty or more students) and one small room to accommodate twenty students provide space for a variety of teaching exercises. Other areas on the fourth floor of the Davison Building include demonstration and conference rooms and a microscopy lab. A computer cluster is available to students twenty-four hours a day with electronic mail capability; a thirty-workstation electronic laboratory is adjacent for computer-assisted educational training for students, faculty, and employees. Recently acquired rooms accommodating two to ten persons are now available on Reed Ward, scheduled by the Central Teaching Lab office. There are seven rooms suitable for physical assessment or small-group learning.

Services provided by the Central Teaching Laboratory include in-house microscope cleaning and repair, exam grading and gradebook maintenance, and course evaluation tabulation and reporting. Room scheduling includes also four large conference rooms in South Hospital for groups of 70 to 160 persons.

Manager: Carol G. Reilly, B.S.

**Division of Audiovisual Education.** The Division of Audiovisual Education serves the Medical Center by providing all types of audiovisual support materials to assist the faculty. There are three sections: Medical Art, Medical Photography, and Instructional Television.

The Medical Art Section provides illustrations produced by various computer graphics and manual art methods and techniques. Services rendered are surgical and anatomic drawings, schematic and mechanical drawings, diagrams, charts, graphs, designs, lettering, calligraphy, signs, and poster exhibits, as well as other forms of illustrations. An extensive computer graphics imaging service is offered for faculty and staff who create slides on desktop computer systems.

The Medical Photography Facility is staffed and equipped to provide a full range of photographic services for patient care, teaching, and research. Patient photography activity includes black and white and color photos in the studio, on the ward, in the clinic, or in the operating room. Copy photography includes a full range of slide services for internal and external lecture and presentation purposes. Black and white and color prints for publication, display and poster session purposes are also available. Other services include daily processing of color prints and of Ektachrome film, location photography, and passport and application prints.

Instructional Television also supports teaching, research, and patient-care programs of the Medical Center. Betacam SP, three-fourths inch U-matic and one-half inch VHS video formats are used for color recording of staff and patient education programs,



lecture presentations, and surgical procedures as part of staff professional education. Other services include fully scripted videotape productions for promotional or information uses, instructional design and computer-based training. Audiotape services, projectionists, and equipment rental are available.

The curriculum materials development project staff works with faculty to produce media materials such as slidetape programs, videotape productions, and computer-assisted instruction programs. These materials may be a regular part of course presentations or may serve as adjuncts to classroom activities.

Director: Thomas P. Hurtgen, M.B.A.

**Duke Hospital.** Duke Hospital, one of the largest private hospitals in the South, is part of the Medical Center and currently is licensed for 1,124 beds. The hospital directs its efforts toward the three goals of expert patient care, professional education, and service to the community. It offers patients modern comprehensive diagnostic and treatment facilities and special acute care and intensive nursing units for seriously ill patients. More than 36,000 patients are admitted annually. Surgical facilities include forty operating rooms in which surgeons perform more than 22,000 operative procedures annually. Approximately 2,200 babies are born each year in the delivery suite. Other special facilities for patients include a heart catheterization laboratory, hemodialysis unit, cancer research unit, medical and surgical intensive care units, hyperbaric oxygenation chamber, and cardiac care unit.

Close working relationships with private and governmental health and welfare agencies provide opportunities for continued care of patients after they leave Duke Hospital.

Ambulatory services include the outpatient clinics, private diagnostic clinics, the employee health service, and the emergency department, with annual total patient visits of over 572,000. The clinical faculty of the Duke University School of Medicine participate in undergraduate and graduate medical education and practice medicine in the hospital and in private diagnostic clinics.

Duke Hospital, with a house staff of approximately 875, is approved residency training by the American Medical Association and is fully accredited by the Joint Commission on Accreditation of Healthcare Organizations.

**Veterans Administration Medical Center.** The Durham Veterans Administration Medical Center, with 435 beds, annually admits over 7,000 patients. The hospital is within walking distance from the School of Medicine and has closely integrated teaching and training programs for medical students and house staff. These programs are provided by the full-time professional staff who are members of the faculty of Duke University School of Medicine.

**Lenox Baker Children's Hospital.** On November 1, 1987 the Lenox Baker Children's Hospital became a part of Duke University Medical Center, entering a new phase in its development as an orthopaedic and rehabilitation center for the children of North Carolina. A full spectrum of orthopaedic and rehabilitation services is offered to identify and meet realistic goals; and to educate, support, and assist families, schools, and communities in providing a rich environment for disabled children.

**Durham Regional Hospital.** Durham Regional Hospital is a county-owned, 451-bed, general, short-term care community facility serving the residents of Durham County. This institution participates in many of the medical and health-related professional training experiences.

**Other Hospitals.** Various cooperative teaching and training programs are available for medical and allied health professional students and house staff at other hospitals including Asheville Veterans Administration Medical Center in Buncombe County, John Umstead Hospital in Butner, Fayetteville Area Health Education Center in Fayetteville, and Cabarrus Memorial Hospital in Concord, North Carolina.

*Program Information*



## **Mission Statement and the Medical Curriculum**

The mission of Duke University Medical Center is:

To provide the most advanced and comprehensive education possible; to prepare our students and trainees for lifetimes of learning and careers as leaders, practitioners, or researchers.

To perform biomedical research producing discoveries that add to understanding life processes and lead to preventing and curing disease and maintaining health.

To translate, to practice and make available to the public, with compassion, the benefits of the unique clinical and technological resources of the Medical Center, and to support our educational and research missions.

To the maximum extent possible, we will apply our core missions in education, research and health care delivery to develop the means to solve regional and national health care problems, including providing accessible, cost-effective health care of measurable quality.

The educational mission of the medical school fits within this overall mission:

To prepare students for excellence by first assuring the demonstration of defined core competencies.

To complement the core curriculum with educational opportunities and advice regarding career planning which facilitates students to diversify their careers, from the physician-scientist to the primary care physician.

To develop leaders for the twenty-first century in the research, education, and clinical practice of medicine.

To develop and support educational programs and select and size a student body such that every student participates in a quality and relevant educational experience.

Physicians are facing profound changes in the need for understanding health and disease and the delivery of medical care, changes which shape the vision of the medical school. These changes include: a broader scientific base for medical practice; a national crisis in the cost of health care; an increased number of career options for physicians yet the need for more generalists; an emphasis on career-long learning in investigative and clinical medicine; the necessity that physicians work cooperatively and effectively as leaders among other health care professionals; and the emergence of ethical issues not



heretofore encountered by physicians. Medical educators must prepare physicians to respond to these changes, and the most successful medical schools will position their students to take the lead addressing national health needs. Duke University School of Medicine is prepared to meet this challenge by educating outstanding practitioners, physician scientists, and leaders.

Continuing at the forefront of medical education requires more than educating Duke students in basic science, clinical research, and clinical programs for meeting the health care needs of society. Medical education also requires addressing such concerns as national science and health policy, meeting the health care needs of society, providing medical care for the disadvantaged, and applying basic science discoveries to clinical medicine. As health care practices at the federal, state, institutional and individual levels evolve, these endeavors need input from physicians uniquely prepared to assume guiding roles.

Duke University's role as a leader in medical education is built upon our internationally-recognized tradition of fostering scientific scholarship and providing excellent preparation for the practice of medicine. Our curriculum promotes creativity, scholarship, leadership and diversity, integrating the basic and clinical sciences and preparing students to pursue the spectrum of options available to modern physicians, from basic science to primary care. Duke University Medical School produces at least three prototype physicians; the physician scientist, the clinician-investigator; and the practitioner (either generalist or specialist).

The Duke faculty enhance the Medical School's curriculum by continually embracing new methods of education and evaluation to improve the medical education experience. Attention to curricular development assures Duke graduates that they are grounded in basic biomedical sciences, are competent and caring clinicians, are prepared to pursue a lifetime of continuing education, and are capable of participating in local, national, and international discussions about the delivery of health care now and in the future. Features of the four-year curriculum include:

- The development of a core medical curriculum that is rigorous, efficient, integrative and forms a realistic base of knowledge for a physician.
- The integration of basic, clinical, psychosocial, and population information and skills throughout the four years of medical education.
- A general introduction to basic and clinical science for one year each, followed by two years of individualized curricular options that promote professional diversity and personal development.
- An elective third year which permits students to pursue their independent scholarly interest across a range of scientific disciplines from basic biomedical science to health policy.
- The promotion of structured active learning that will include explicit experience in leadership and cooperative roles.
- The mentoring of students by faculty in all facets of the learning process.
- The implementation of a standardized and valid assessment of progress, carefully and thoughtfully evaluating the acquisition of knowledge, skills, and attitudes appropriate to the future goals of each student.
- The incorporation of information technology and the use of computers into student learning and evaluation.
- The researching and implementation of new and improved methods of teaching.

The curriculum, while offering a previously unattainable degree of flexibility to medical education and new opportunities for intellectual exploration, also makes heavy demands upon the student. It should be recognized that medical students at the Duke University School of Medicine are expected to maintain a consistent level of performance

and to demonstrate qualities of initiative and dedication to their chosen profession. A scholarly attitude toward medicine that will continue throughout an entire career is an important objective of the medical school. The foundations of this attitude to learning should accompany the student upon entering.

Students are expected to maintain at all times a professional attitude toward patients, to respect confidences, and to recognize that they are the recipients of privileged information only to be discussed within the context of scholarship and in circumstances that truly contribute to the educational process or to the care of the patient. This attitude involves consideration not only of speech and personal appearance but also of morality, honor, and integrity.

Beginning in the fall of 1987, the School of Medicine greatly enlarged the focus on ethics and human values in the curriculum. In the face of major advances in medical technology and sciences, today's medical student must be prepared to deal with new complexities of medical practice. These advances and complexities also make it of paramount importance that medical education enable each student to grow in both depth and breadth as a human being. The Duke University School of Medicine is rising to this challenge.

## Doctor of Medicine Degree

The degree of Doctor of Medicine is awarded, upon approval by the faculty of Duke University, to those students who have satisfactorily completed the academic curriculum; demonstrated the intellectual, personal, and technical competencies to function as a skilled physician; demonstrated their fitness to practice medicine by adherence to a high standard of ethical and moral behavior.

The faculty of Duke University School of Medicine have developed general guidelines for technical standards for medical school admissions and degree completion. These are available on request from the school.

The awarding of degrees is contingent upon payment of, or satisfactory arrangements to pay, all indebtedness to the university.

In May, 1988, the Duke University School of Medicine was fully accredited for seven years by the Liaison Committee on Medical Education of the Association of American Medical Colleges and the Council on Medical Education of the American Medical Association. Full accreditation is expected for seven years in November, 1994, after which the complete Self Study Review and LCME database will be available for inspection to anyone upon request to the Registrar's Office, 125 Davison Building, phone 919/684-2304.

**Course Requirements—First Year.** The student studies the principles of all the basic science disciplines. Rather than mastering an encyclopedic array of facts, the purpose is to acquire familiarity with the major principles of each subject. In addition, the School of Medicine has developed a program offered in the form of a required course (Clinical Arts) that provides an opportunity for students to learn basic medical science through active self-learning centered in a clinical context. The year consists of instruction in the following:

Semester 1	Credit
BCH 200 - Biochemistry	4
GEN 200 - Genetics	2
CBI 200 - Cell Biology	2
CBI 201 - Microanatomy	2
CBI 202 - Medical Physiology	4
BAA 200 - Gross Human Anatomy	4
IND 200 - Fundamental Issues in Health Care	1
CLA 200 - Clinical Arts	0
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Semester 2	Credit
NBI 202 - Basic Neurobiology	4
PSC 200 - Human Behavior	2
MIC 200 - Microbiology	5
IMM 201 - Immunology	2
PHR 200 - Pharmacology	4
PTH 200 - Pathology	5
IND 200 - Fundamental Issues in Health Care	1
CLA 200 - Clinical Arts	0
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Following the first year, there is a vacation before the Introduction to Clinical Diagnosis course starts in the third week of July. Every class has Thanksgiving, Christmas, Martin Luther King, Jr. holiday, and spring break with the exact dates depending upon rotation and class schedules.

**Course Requirements—Second Year.** Satisfactory completion of the first year curriculum is a prerequisite to the second year curriculum. The second year provides an exposure to clinical science disciplines, which permits students early in their careers to become participants in the care of patients. The acquired appreciation of the problems of the clinical areas and the opportunities to recognize the applications of the basic sciences should lead to a more meaningful selection of courses for the subsequent two years.

The Introduction to Clinical Medicine course, which occupies the seven weeks preceding the core clinical rotations, is followed by eight-week rotations in internal medicine, surgery, obstetrics/gynecology, pediatrics, a six-week rotation in psychiatry, and either an eight-week rotation in family medicine or a four-week rotation in family medicine and a four-week rotation in neurology. A core clinical rotation in cost effective care lasting two weeks follows the psychiatry rotation.

The clinical performance examination (CPX) is a standardized test of clinical performance that all students must take and pass after completing second-year clerkships. It was developed by faculty from all four medical schools in North Carolina and is now administered at all schools. The purpose of the CPX is to evaluate the effectiveness of the clinical curriculum and individual student's ability to respond to patient problems and concerns. Skills of relating to and communicating with patients, history taking, physical examination, differential diagnosis and initial management are evaluated for fifteen different patients. Students performing below minimal competency on the CPX will have additional structured learning required during their fourth year.

**Course Requirements—Third and Fourth Years.** Satisfactory completion of the second year curriculum is a prerequisite to the elective curriculum. The third and fourth (elective) years of undergraduate medical education build upon the experience in basic science and clinical medicine gained in the earlier years. The elective years consist of four semesters of sixteen weeks each. In addition, the fourth year has an optional summer term also of sixteen weeks. Successful completion of sixty-four elective credits (typically thirty-two basic science credits during the third year and thirty-two clinical science credits during the fourth) is required for graduation. Course offerings are described in the different departmental sections in this bulletin. The wide selection affords an opportunity for the student, with guidance from advisers, to design a program that best satisfies her or his needs.

**Third Year.** The purpose of the scholarly experience, usually occurring in the third year, is to provide the student with an opportunity to focus in an area or areas of interest and to pursue, in depth, a scholarly activity. Time may also be spent gaining strength in areas of basic science weakness. Each student determines a home base study program for the basic science elective experience. With the aid of advisers, the individual elective program is devised to include an area of scholarly work to pursue which may or may not be an independent research project. Any combination of: (a) research preceptorship, (b) tutorials, or (c) courses inside or outside the home base study program may comprise



the overall basic science elective experience. With rare exception, the elective experience should be taken as a block. During the eight months that comprise the third year, students are required to complete thirty-two basic science credits.

**Fourth Year.** The clinical elective experience, usually occurring in the fourth year, should be used to: (a) aid in decision making about the area of choice of postgraduate training, (b) obtain experiences in areas that would not be included in that postgraduate training, and, above all, (c) pursue active experiences in patient care sufficient to provide the basic skills necessary for doctor-patient interaction. To satisfy requirements for the M.D. degree, students must complete thirty-two clinical science credits during the fourth year. Four of these credits must be completed in an elective requiring direct patient care.

**Academic Standards.** The faculty of the Duke University School of Medicine has the responsibility to define minimum acceptable standards for academic performance. In all courses, minimum passing standards are defined by the course director in collaboration with her or his department chairperson and faculty. These standards are communicated to the students at the beginning of each course. In clinical departments, acceptable professional standards of behavior and attitudes are included in performance evaluation.

Faculty have the responsibility to notify students who are not meeting minimal standards for passing a course early enough for the student to be able to work toward achieving the minimal standard by the end of the course. In most cases, this is at the midterm of a course. Tutorial help or guidance in correcting deficiencies should be offered to any student so notified.

**Promotion.** Where appropriate, certification by the individual faculty person or by the delegated representative of each departmental chairman that a student has satisfactorily completed requirements for a course shall constitute grounds for a grade of *Pass* (P) or *Pass with Honors* (H). *Pass with Honors* is reserved for those students who have performed in an exemplary manner in the opinion of the faculty. A grade of *Satisfactory* (S) or *Unsatisfactory* (U) is used to rate performance in a course for which the award of the grade of H is prohibited.

An *Incomplete* (I) grade is reserved for those students who have not met all of the requirements because of illness or other such extenuating circumstances, or because of the inability to attain sufficient understanding of course material without additional study. *Incompletes* that are not satisfied within one calendar year (unless an extension is granted by an advisory dean and the registrar) automatically become grades of *Fail* (F). It is the departmental chairman's responsibility or that of the delegated representative of the departmental chairman to certify that an *Incomplete* has been satisfied and to so notify the registrar. A passing grade is placed alongside an *Incomplete* on the permanent and official transcript. All first year courses must be satisfactorily completed before a student may enroll in second year courses. Normally, all second year courses must be satisfactorily completed before a student may enroll in the elective curriculum.

A *Fail* grade is recorded on the permanent record of a student by the registrar upon certification by the individual faculty person or the delegated representative of the departmental chairman that unsatisfactory work has been done in the opinion of the faculty. Failures cannot be erased from the permanent record but the requirements of the course may be satisfied by repeating the course in a satisfactory manner at which time a passing grade is recorded on the official and permanent transcript. A grade of *Honors* cannot be awarded to students in courses that are successfully remediated rather than remediated.

Each student's record is reviewed periodically by promotions committees composed of course directors or their designees from the appropriate departments. Recommendations by these committees are made to the dean of medical education who may follow one of several options:

1. Promote students whose work is satisfactory;

2. Warn students whose work is less than satisfactory that they must improve their scholastic endeavor;
3. Place on probation students whose work is unsatisfactory; or
4. Request the resignation of any student who is considered an unpromising candidate for the degree of Doctor of Medicine.

A student wishing to appeal a decision may do so to the dean of medical education within two weeks of notification.

The dean of medical education, with the advice of the Medical Center Policy Advisory Committee, reserves the right to require the withdrawal of any student at any time if, in his opinion, the student should not continue in the School of Medicine.

**Due Process Guidelines.** If a student decides to appeal a decision of any promotions committee, he or she must submit in writing to the dean for medical education the reasons for the disagreement with the decision and any extenuating circumstances he or she wishes to identify within two weeks of receiving notice of the decision. Within a week of receiving the appeal, the dean for medical education appoints a Promotions Appeal Committee of three senior faculty, at least one of whom is from a basic science department. The Promotions Appeal Committee reviews the student's request, and meets with other faculty or members of the DUMC staff who have pertinent information. The student may present her or his appeal in person and may bring a friend from the faculty or student body to assist. The Promotions Appeal Committee reports its decision to the dean for medical education who presents this to the student. If the student is still dissatisfied and wishes to appeal further, he or she may request a review of the whole process by the dean of the School of Medicine, and all the documentation is provided to that office. The dean's decision, with the advice and consent of the Medical Center Policy Advisory Committee (MEDPAC), is binding.

**Satisfactory Academic Progress.** Satisfactory academic progress for students in the School of Medicine is construed as the successful completion of all requirements necessary for the advancement from one year to the next. These requirements are as follows:

*First to Second Year.* Completion of core basic science courses in one calendar year.

*Second to Third Year.* Completion of core clinical science courses within fourteen months.

*Third to Fourth Year.* Completion of thirty-two basic science credits within nine months.

*Fourth Year to Graduation.* Completion of thirty-two clinical science credits within one calendar year.

In unusual circumstances (including illness, remediation or irregular sequence of courses) the determination of satisfactory progress (for academic purposes) is made by the dean for medical education.

For financial aid purposes, federal regulations establish the maximum time frame for completion of the program at 150 percent of the minimum time required to complete the program. Any student exceeding the 150 percent maximum time frame is ineligible for Title IV (Stafford) student financial aid funds.

**Course Load.** During the elective years, the normal registration for any term is sixteen credits. The maximum registration is eighteen credits with no more than five credits in any four-week period. Enrollment for credit above this limit must have the written approval of the advisory dean.

**Audit and No Credit Courses.** With the consent of the appropriate instructor, *fourth* year students are permitted to audit one course a semester in addition to the normal program. Students who audit a course do not actively participate, submit work, or receive credit for the course. Because of the nature of an audited course, most clinical



science courses cannot be audited. However, those offered in a lecture format (as indicated in the Elective Book provided to third and fourth year students) may be audited with the written permission of the instructor. After the first week of classes in any term, no course taken as an audit can be changed to a credited course and no credited course can be changed to an audit. Further, an audited course may not be repeated for credit.

Third year students may register on a "no-credit" basis only for clinical courses whose total, combined weight does not exceed four. Such courses are not considered to be "audits." Students are expected to participate fully in these courses and are graded upon the quality of their work.

**Leave of Absence.** A student, after presenting a written request to the dean of medical education, may be granted an official leave of absence for personal or academic reasons for two or more consecutive terms but not to exceed one calendar year. If approved, the dean provides written notification including applicable beginning and ending dates to the student, the registrar, and the director of financial aid. The student must apprise the dean in writing of her or his wish to return to the Medical School or to extend the personal leave at least sixty calendar days prior to the anticipated date of re-entry. The student desiring an extension beyond one calendar year may be required to apply for readmission to the School of Medicine. When a leave of absence is taken during the first or third year, the dean may require the student to repeat some or all of that year's academic program. To be eligible for a voluntary leave of absence, a student must have met all financial obligations to the university.

Permission to take a leave of absence for medical reasons must also be sought in writing and is usually granted for thirty days. If additional medical leave time is desired, the student's physician is requested to submit documentation concerning the need for a continuation of the leave. A medical leave extending beyond ninety days requires a statement from the student's physician attesting to her or his fitness to return to the Medical School as a full-time student.

For purposes of deferring repayment of student loans during a school approved leave of absence, federal regulations limit the leave to six months.

In all cases of leave of absence, the student is required to complete the full curriculum to be eligible to earn the M.D. degree.

**Commencement.** Graduation exercises are held once a year, in May, when degrees are conferred on, and diplomas are issued to, those who have completed requirements by the end of the spring semester. Those who complete degree requirements at the end of the fall or summer terms receive diplomas dated 30 December or 1 September, respectively. There is a delay of about one month in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

**Interinstitutional Program.** Under an agreement with Bowman Gray Medical School, East Carolina University School of Medicine, and the University of North Carolina-Chapel Hill School of Medicine, Duke Medical School allows students participating in the elective program to take courses at participating institutions for grades and credit toward the M.D. degree at Duke. Courses taken are usually not available at the home institution or are not offered at times that can be accommodated by the student's schedule. Students enrolled in interinstitutional courses are charged the current Duke tuition and student health fees.

**Medical Licensure.** "The Federation of State Medical Boards (FSMB) and the National Board of Medical Examiners (NBME) have established a single, three-step examination for medical licensure in the United States. The United States Medical Licensing Examination (USMLE) provides a common evaluation system for applicants for medical licensure." (*USMLE 1995 Bulletin of Information*) Step 1 concentrates on basic



science knowledge, Step 2 on fundamental clinical science knowledge, and Step 3 on advanced clinical science knowledge. Steps 1 and 2 can be taken in any order, but must be passed before applying to take Step 3. Of course, a full license requires also appropriate application procedures and fees for the state in which the license is issued.

Duke University School of Medicine does not use any step of this examination for evaluation of students for progress through the curriculum. Passing the examinations is the responsibility of the individual, and Steps 1 and 2 may be taken when the individual is prepared to do so. The curriculum is not directed toward preparing students for licensure examination, but successful performance in coursework should enable all students to successfully pass each step. In 1995, Step 1 is offered in June and September and Step 2 in March and August; applications are available in the Central Teaching Lab. Step 3 is offered in June and December and applications are available from the North Carolina State Board of Medical Examiners in Raleigh, NC. Students typically take Steps 1 and 2 while in medical school. The Office of Medical Education assists students as they decide the most appropriate times during medical school to take these steps and with suggestions for preparing for the examination.

**Visiting Students.** The School of Medicine provides opportunities for visiting students to enroll in elective courses for a maximum period of eight weeks. The School of Medicine does not offer long term or extensive clinical experience (sometimes called externships or clerkships) sufficient to satisfy the clinical educational requirements of foreign medical schools. Payment of a registration fee (currently \$50, subject to change) and a student health fee are required. For information write to: Coordinator, Visiting Students, Box 3005, Duke University Medical Center, Durham, North Carolina 27710.

**Education Records.** In accordance with the Family Education Rights and Privacy Act of 1974 (FERPA), Duke University permits each student to inspect her or his education records and limits disclosure to others of personally identifiable information without the student's prior consent.

Education records include those records which contain information directly related to a student and are maintained as official working files by the university. They do not include records made by faculty and administrators for their own use and not shown to others; campus police records; employment records; records of physicians, psychologists, etc., made or used only for treatment purposes; and records containing information relating to a person's activities after she or he graduates or withdraws from the university.

Certain categories of information are considered to be directory information and, as such, do not require the student's prior written consent to be disclosed. However, upon written notice, the Medical School Registrar's Office is happy to comply with a student's request to withhold such information. The following have been designated as directory information by the university: name, address, telephone listing, date and place of birth, photograph, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and most recent previous educational institution attended.

In addition, prior consent is not required for disclosure of education records to school officials of Duke University who have been determined to have legitimate educational interests, appropriate parties in connection with an emergency, and in response to a court order or subpoena.

Following appropriate procedures, the student may challenge the content of the education record. Information on additional exceptions or the complete policy and procedures of Duke University in regard to FERPA is available upon request at the Office of the Medical School Registrar.

## Combined Degree Programs

**Medical Scientist Training Program.** The Medical Scientist Training Program is designed for highly qualified students strongly motivated toward a career in medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the full clinical curriculum of the School of Medicine. The program requires, on the average, six to seven years of study and leads to both the M.D. and Ph.D. degrees. Although the special emphasis of this program is on basic medical science, the trainees, because of their education in clinical medicine, have a remarkable range of career opportunities open to them. Graduates of this program follow one of two broad paths. Some embark directly on careers in teaching and research in one of the basic medical sciences, while maintaining strong ties with clinical science as a result of their combined training. Others enter residency programs before pursuing investigative and teaching careers in clinical medicine, carrying with them strong academic backgrounds which allow them to conduct fundamental research with a foundation of superior training and experience in basic sciences.

**Eligibility.** Applicants must meet the admission requirements of both the Medical School as a candidate for the M.D. degree, and the Graduate School as a candidate for the Ph.D. degree. Most candidates apply for admission to the first year of the program, but in special cases applications can be accepted from students who are in residence in the Medical School or Graduate School of Duke University. In addition to the minimum requirements for acceptance to the Medical School and the Graduate School, advanced course work in science and mathematics and prior research experience (or other evidence of research aptitude) counts heavily in the selection of candidates.

**Financial Support.** Students admitted to the first year of the program receive a traineeship award, consisting of a stipend and full tuition allowance, provided by a National Research Service Award from the National Institutes of Health. Currently the annual stipend is \$12,500, and financial support from that award can be furnished for up to six years, assuming normal progress. These six years need not be consecutive; this permits flexibility in funding in case more than six years are required for completion of the curriculum. Funding by the NIH is limited to citizens or permanent residents of the United States.

**The Training Program.** This program is designed to offer trainees great latitude in the selection of course material. Basic requirements are two academic years composed of the first basic science year and the second clinical science year of the curriculum for medical students at Duke University. Following completion of the second year, the trainee enters the graduate program to complete the requirements for the Ph.D. degree. One more academic year of elective clinical study is necessary to complete the requirements for the M.D. degree. Both degrees are awarded at the completion of this sequence. Minor variations in this schedule can be arranged if this is advantageous to the student's education.

**Year 1—Core Basic Science Year.** This year consists of courses in anatomy, biochemistry, cell biology, genetics, human behavior, immunology, microbiology, neurobiology, pathology, pharmacology, and physiology.

**Year 2—Core Clinical Science Year.** This year encompasses a comprehensive approach to medicine oriented to the patient as a whole. The year provides fundamental training in clinical medicine, with emphasis on the relationships between general biological processes, from conception through birth, development, and maturation to senescence and death, as well as individual clinical states. Special consideration is devoted to the pattern of developmental sequences and to the changes in that pattern determined by genetic composition and the particular environment in which the patient lives.

During the second year, the trainee is taught primarily by teacher-investigators from the clinical departments. The Introduction to Clinical Diagnosis course occupies the seven weeks preceding the core clinical rotations.



The balance of the second year consists of eight-week rotations in internal medicine, surgery, obstetrics/gynecology, and pediatrics, a six-week rotation in psychiatry coupled with a two-week rotation in cost effective care, and either an eight-week rotation in family medicine or a four-week rotation in family medicine and a four-week rotation in neurology.

*Years 3, 4, 5, (6)—The Graduate Years.* During the third, fourth, fifth and, if necessary, sixth year of the program, the trainee pursues graduate study to satisfy the requirements for the Ph.D. degree.

These requirements include: (1) completion of necessary course work, (2) adequate performance in the preliminary examination, (3) original research suitable for a dissertation, and (4) successful defense of the thesis in the final examination. Detailed description of the other general requirements for the Ph.D. degree are stated in the *Bulletin of the Graduate School*.

The graduate curriculum of each trainee is developed in consultation with the director of graduate studies of the department in which the trainee elects to study and requires the approval of the Medical Scientist Training Program Committee. Since most of the ordering ideas and experimental techniques of all the medical sciences derive from mathematics and the physical sciences, it is essential to ensure that all students in the program have an adequate foundation in these subjects. Because of the close working relationship and geographical proximity of the departments of medical and physical sciences at Duke, the setting is unusually favorable for the achievement of that goal.

Descriptions of the graduate courses in the Departments of Biochemistry, Cell Biology, Microbiology, Immunology, Neurobiology, Pathology, Pharmacology, Biomedical Engineering, Chemistry, Zoology, the Department of Molecular Cancer Biology, and Genetics are listed in the *Bulletin of the Graduate School*. Trainees are encouraged to select courses which relate to their developing individual interests rather than follow a prescribed curriculum applied to all students in a given discipline. Such range, flexibility, and freedom are the essence of graduate education. The original research and dissertation of each trainee is supervised by a faculty adviser chosen by the trainee in consultation with the director of graduate studies in the appropriate department. The faculty adviser is the chairman of the trainee's supervisory committee, which consists of at least three members from the major department. This committee generally administers the preliminary examination before the student commences original research and the final examination after the student completes the dissertation.

*Final Year—An Elective Year in Clinical Science.* In this year, which is entered only after completion of all requirements for the Ph.D. degree, a faculty adviser from the clinical discipline in which the student is most interested is assigned. The student and the adviser construct an individualized curriculum, which often places major emphasis on one clinical area and minor emphasis on other fields. One aim is the integration of research interests and clinical experience in such a way that the student's research competence is facilitated; therefore, this year is planned with regard to the trainee's proposed career in research as well. This elective year provides further training in clinical medicine to complement the second or core clinical year, so that the trainee's total clinical experience is the same as that given in the regular clinical years of medical school (the third and fourth years in the majority of schools). It should be noted that since students in the program receive the M.D. degree upon completion of this final year, great care is taken by the faculty to ensure that students are competent and knowledgeable in current concepts of patient care. It is hoped that the final year provides the student with an experience which is not repeated during the residency but serves to complement later phases of training. Thus, future surgeons might be exposed to fields other than surgery, since they receive intensive training in that discipline during their residency programs.

*Application and Admission Procedure.* The following guidelines should be observed by individuals applying to the Medical Scientist Training Program.



1. The application form for the Duke University School of Medicine should be completed and submitted as early as possible, since acceptance into the Medical Scientist Training Program requires acceptance by both the Program Committee and the Medical School Admissions Committee. Applicants who cannot be accepted into the program are still fully eligible for acceptance to the Medical School if the Medical School Admissions Committee considers them qualified and desirable.
2. The application form for the Medical Scientist Training Program should be completed and submitted no later than 1 December.
3. To facilitate review of this application, the Medical College Admission Test should be taken, if possible, in April of the year in which the application is submitted.
4. Only those applicants who are accepted for the program are requested to complete an application form for the Graduate School. The Graduate Record Examination is not required for this purpose.
5. Applicants are notified about acceptance into the program on or about 15 February.

Additional information may be obtained by writing Salvatore V. Pizzo, M.D., Ph.D., Director, Medical Scientist Training Program, Box 3712, Duke University Medical Center, Durham, North Carolina 27710.

**Primary Care Physician Program.** Duke University School of Medicine instituted, effective September, 1994, the Primary Care Physician Program for medical students. The goal of the program is to develop leaders in primary care disciplines of medicine. Any student matriculating to the Medical School and expressing an interest in becoming a primary care physician can apply to join this program. The program functions much as an academic society, with periodic informal meetings of generalist faculty and program students. Students work with primary care faculty in the Clinical Arts Course during the first year. They are encouraged to elect the eight-week family medicine clerkship during the second year. Though the third and fourth years remain elective years for all medical students, Primary Care Program students are encouraged to participate in either the Biometry and Medical Informatics or Epidemiology, Health Services and Health Policy study programs during the third year. These study programs provide an opportunity for dual degrees, such as M.D./M.H.S., M.D./M.P.P. or M.D./M.P.H. During the fourth year of clinical electives, students will be encouraged to take the basic neurology clerkship, a generalist subinternship, and at least one ambulatory care rotation in a generalist discipline, such as community medicine or geriatric medicine. Throughout the four years, students are assigned a primary care preceptor as well as an advisory dean and participate in a continuity of care experience. Students may join the program at any time during the first three years and may withdraw from the program at any time. Participation in the program does not necessitate a primary care career choice. The program is jointly sponsored by the Departments of Community and Family Medicine, Medicine, Obstetrics/Gynecology, and Pediatrics. Additional information may be obtained by writing Barbara Sheline, M.D., M.P.H., Box 2914, Duke University Medical Center, Durham, NC 27710.

**The Medical Historian Program.** The Medical Historian Program is conducted under the auspices of the School of Medicine and the Graduate School. Two courses are offered: a combined M.D.-Ph.D. (extending over six years) and a M.D.-M.A. (four or five years depending on use of summer sessions). The choice of Ph.D. or M.A. depends on the career goals of the students. Those wishing to put a major effort into scholarly activities in the history of medicine will generally be advised to undertake the Ph.D.

The basic requirements for both courses are two academic years in the School of Medicine consisting of core basic sciences in the first year and core clinical rotations in the

second year. The student then enters the Department of History. A range of appropriate courses are available.

Following the completion of the Ph.D. or master's degree, the student resumes requirements for the M.D. degree. Individuals earning the Ph.D. degree in history may petition the dean for medical education to receive transfer credits to be applied to the medical school degree if the major subject area is one that is related to the discipline of medicine, health policy, or public health.

*Application and Admissions Procedures.* Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History. Candidates who have completed two years of medical school are also considered. In addition to the minimum requirements established by the School of Medicine and the Graduate School, courses in history and in the history and philosophy of science count in the selection of candidates.

Applicants should complete and submit an application form to the Duke University School of Medicine and to the Graduate School for admission to the Department of History.

Additional information may be obtained by writing to: Peter C. English, M.D., Ph.D., Box 3675, Duke University Medical Center, Durham, North Carolina 27710.

**The Medicine and Public Policy Program.** This four-year program is offered to meet the growing demand for persons who combine medical skills and training with a capacity for analytic public decision-making. It aims at training those persons with requisite talent to be leaders in the development and implementation of health policy at all levels of government. Such leadership might be provided as an elected or career public official, as a leader of medical professional organizations, or as a practicing physician or medical scholar active in public affairs.

Utilizing the faculty and resources of the School of Medicine and the Terry Sanford Institute of Public Policy, the program offers students a multidisciplinary education that aims at providing:

1. A complete course of study in basic medical sciences and clinical training in the practice of medicine identical in scope and rigor with the education received by students enrolled in the Doctor of Medicine program alone;
2. Familiarity with the organization and financing of health services, with particular focus on the economics and politics of health care;
3. An understanding of the political, bureaucratic and social processes that define public problems and limit alternative approaches to their solutions;
4. A capacity for quantitative and logical methods of analysis useful in forecasting and appraising policy consequences and in evaluating existing policies;
5. An understanding of the uses and limitations of various analytic techniques and an awareness of the value considerations and ethical choices implicit in particular policy alternatives.

During the first two years at Duke, students enroll in the normal course of study in the School of medicine. In the third year, course work shifts to the institute. In addition to the normal public policy curriculum, combined degree students are required to complete an epidemiology course and a course on the U.S. health care system. Between the third and fourth years, students have a ten-week policy internship. During the fourth year, students complete their requirements in the School of Medicine, at the completion of which they receive both the M.D. and Master of Public Policy (M. P. P.) degrees.

*Admissions.* Students may apply for admission to the program in medicine and public policy concurrent with application to the School of Medicine or during their first or second years.

*Applications.* Requests for applications and specific questions about the program should be addressed to the Director of Graduate Studies, Terry Sanford Institute of Public Policy, P.O. Box 90243, Durham, North Carolina 27708-0243. Inquiries can also be addressed to Arthur T. Garson, M.D., Box 3090, Duke University Medical Center, Durham, North Carolina 27710.



**The M.D.-J.D. Program.** The School of Medicine and the School of Law of Duke University jointly sponsor a highly selective program of combined medical and legal education. The program provides an opportunity to acquire a full basic study of the two fields. Upon satisfactory completion of the required course of study, candidates are awarded both the M.D. and the J.D. degrees.

**Course of Study.** The student in the M.D.-J.D. Program generally begins a six-year course of study in the School of Medicine. As in the regular M.D. Program, the first year is devoted to the basic medical sciences and the second year to the basic clinical disciplines. At this point the student enters the School of Law, where the first-year curriculum is the same as that of other law students. During the next two years the student takes approximately one and one-half years in the law curriculum, including available health law courses, and one-half year of elective basic science work. In addition, some students pursue legal clerkships during these two summers to gain experience in health care law. The sixth and final year is spent in elective clinical work in the medical school tailored to the student's specialized needs.

**Eligibility.** Applicants for the M.D.-J.D. Program must qualify for admission to both the School of Medicine and the School of Law. The usual approach is to apply for both schools simultaneously, thus reserving a place in the program prior to arrival. Applications are also accepted from members of the first and second year medical school class for admission to the School of Law and from the second year law school class for admission to the School of Medicine. Neither school gives preference to joint degree candidates in the admissions process.

**Application Procedure.** Application forms for the School of Law may be obtained by writing to the Office of Admissions, Duke University School of Law, Durham, North Carolina 27706. Applications for the School of Medicine shall be made by utilizing the AMCAS procedure described in this bulletin.

**Deadlines.** For those seeking simultaneous admission to both schools: at the end of the junior year take the new Medical College Admissions Test (MCAT) and the Law School Aptitude Test (LSAT).

For the Medical School, complete the AMCAS application procedures. Upon receipt of the supplemental application form from Duke, check the box indicating M.D.-J.D. Program. Deadline for AMCAS procedure is 1 November. There is no deadline for the Law School but 15 January or earlier submission is suggested.

**The M.D.-M.P.H. Program.** Students enrolled in the School of Medicine, after satisfactory completion of the first two years of the regular curriculum, may request approval to seek a Master of Public Health degree at the University of North Carolina, Chapel Hill, or at another approved institution. The program is designed to train physicians in epidemiology, biostatistics, maternal and child health, and in health policy and administration, and evaluating health care delivery systems. Upon receipt of the M.P.H. degree, students are awarded a full year of basic science credit toward the M.D. degree.

For additional information contact the M.D.-M.P.H. Advisor, John R. Feussner, M.D., M.P.H., F.A.C.P., Box 3240, Duke Medical Center, Durham, NC 27710 or call 919/296-6936.

## Graduate Medical Education

**Accreditation Council for Graduate Medical Education Programs.** Appointments are from 1 July through 30 June with few exceptions. Residents receive stipends, professional liability insurance, disability insurance, life insurance, health insurance, parking, on-call meals, psychological counseling, uniforms, and laundry of uniforms.

Programs offered with the program training director of each service are as follows:

A&I Diagnostic Lab Immunology.....	Dr. Rebecca Buckley
Allergy/Immunology.....	Dr. Rebecca Buckley



Anes: Critical Care .....	Dr. Robert Sladen
Anes:Pain Management .....	Dr. Bruno J. Urban
Anesthesiology .....	Dr. J. G. Reves
Cardiology .....	Dr. Gary Stiles
Child Neurology .....	Dr. Darrel Lewis
Child Psychiatry .....	Dr. Charles Keith
Critical Care Medicine .....	Dr. William Fulkerson
Critical Care Pediatrics .....	Dr. William Greeley
Dermatology .....	Dr. Sheldon Pinnell
Dermatopathology .....	Dr. Robin Vollmer
Endocrinology/Metabolism .....	Dr. Marc Drezner
Family Practice .....	Dr. Kathryn Andolsek
Gastroenterology .....	Dr. Rodger Liddle
General Pediatrics .....	Dr. Deborah Squire
Hematology .....	Dr. Russell Kaufman
Infectious Diseases .....	Dr. John Hamilton
Int. Med-Geriatric Med .....	Dr. Harvey Cohen
Internal Medicine .....	Dr. Joseph Greenfield
Int. Med-Neurology .....	Drs. Corey/Morganlander
Medical Microbiology .....	Dr. Barth Reller
Medical Oncology .....	Dr. Russell Kaufman
Medicine-General .....	Dr. Jeff Wong
Medicine/Pediatrics .....	Drs. Corey/Kinney
Medicine/Psychiatry .....	Drs. Corey/Grady
Neonatal-Perinatal Med .....	Dr. David Tanaka
Nephrology .....	Dr. William Yarger
Neurological Surgery .....	Dr. Robert Wilkins
Neurology .....	Dr. Allen Roses
Neuropathology .....	Dr. Doyle Graham
Nuclear Medicine .....	Dr. Edward Coleman
Ob-Gyn .....	Dr. Charles Hammond
Ophthalmology .....	Dr. Stephen Pollock
Orthopaedic Hand Surgery .....	Dr. James Urbaniak
Orthopaedic Surgery .....	Dr. James Urbaniak
Otolaryngology .....	Dr. William Richtsmeier
Path: Cytopathology .....	Dr. William Johnston
Pathology .....	Dr. William Bradford
Pediatric Cardiology .....	Dr. Tim Garson
Pediatric Endocrinology .....	Dr. Michael Freemark
Pediatric Hematology-Oncology .....	Dr. John Falletta
Pediatric Metabolism/Genetics .....	Dr. Charles Roe
Pediatric Nephrology .....	Dr. John Foreman
Pediatric-Infectious Disease .....	Dr. Michael Frank
Pediatric Rheumatology .....	Dr. Deborah Kredich
Pediatric Pulmonology .....	Dr. Thomas Murphy
Pediatric Radiology .....	Dr. George Bissett
Pediatrics .....	Dr. Tom Kinney
Plastic Surgery .....	Dr. Donald Serafin
Prev. Med: Occupational .....	Dr. Woodhall Stopford
Psychiatry .....	Dr. Tana Grady
Psychiatry-Geriatric .....	Dr. John Breitner
Pulmonary Diseases .....	Dr. James Crapo
Rad-Neuroradiology .....	Dr. Robert Tien
Radiation Oncology .....	Dr. Ed Halperin
Radiology: Diagnostic .....	Dr. James Bowie
Radiology: Diagnostic (Nuclear) .....	Dr. Edward Coleman
Rheumatology & Genetics .....	Dr. Barton Haynes
General Surgery .....	Dr. Theodore Pappas

Surgery: Critical Care .....	Dr. Lawrence Reed II
Thoracic Surgery .....	Dr. Walter Wolfe
Urology .....	Dr. David Paulson

Duke University Medical Center is a participating member of the National Resident Matching Program, 2450 N Street N.W., Suite 201, Washington, DC 20037-1141, and all applicants for first-year postmedical school appointments must register with this program.

Both men and women graduates of any L.C.M.E.-accredited medical school are eligible for appointment and all applicants are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex or age (except where sex and age are a bona fide occupational qualification).

Requests for application forms and information about straight residencies should be addressed to the program training director of the service under which training is desired. A transcript of the medical school record is required, and must either accompany the application or be furnished by the dean of the Medical School.

Graduates of medical schools outside the United States and Canada must hold a valid standard or interim certificate from the Educational Commission for Foreign Medical Graduates (ECFMG), 3624 Market Street, Philadelphia, Pennsylvania 19104, to be considered for appointment to residencies. Physicians who are not U.S. citizens or permanent residents and who need sponsorship as J-1 exchange visitors must have passed required exams to be eligible for a visa. The required exams are: the United States Medical Licensing Exam (USMLE), Steps 1 and 2; or the National Board of Medical Examiners Exam (NBME), Parts I and II, or the or the Visa Qualifying Examination (VQE); or a combination of these which is acceptable to ECFMG; plus an English language exam acceptable to ECFMG. Visas other than the J-1 may be available to physicians who have passed additional exams and hold additional qualifications. Applications should be sent directly to a department or division. An application which does not include a copy of a valid ECFMG certificate and evidence of passage of one of the required exams is considered incomplete and may be discarded without further notice to the applicant. For further information contact Catheryn Cotten, International Office, Box 3882, Duke University Medical Center, Durham, North Carolina 27710.

Reasonable requests for reduced scheduling are considered. Inquiries should be directed to the program training directors of approved residencies or to the Office of House Staff Affairs. For further information, please contact the House Staff Office, Box 3951, Duke University Medical Center, Durham, North Carolina 27710.

The Durham Veterans Administration Medical Center adjoins the Duke University Campus and is operated under the supervision of the vice-president's Committee of the Duke University Medical Center. The full-time professional staff of the V.A. Medical Center are all faculty members of the School of Medicine. All training programs are integrated with corresponding programs at the Duke University Medical Center, including rotation of house officers at each hospital.

All trainees are required to be licensed by the State of North Carolina. This may be accomplished by (1) a residency training license that covers only training by Duke and is not convertible to a full North Carolina license or (2) a full North Carolina license that is a complete medical license. A complete medical license is obtained either by state boards, (North Carolina Boards can only be taken upon completion of internship) FLEX, USMLE Step III or National Boards. North Carolina is not reciprocal with other states for full licenses. Duke University Medical Center cannot make applications for house staff. Since house staff members must have the license before beginning duties, arrangements for the license should be made in advance. All incoming house staff must contact the House Staff Office, Box 3951, DUMC, Durham, North Carolina 27710 for current licensure requirements.

Application forms and information for residencies or fellowships may be obtained by writing the program training director of the appropriate department, Duke University Medical Center, Durham, North Carolina 27710.

**Auditing of Courses by House Staff.** Residents and fellows at the Medical Center may audit courses through the undergraduate and graduate divisions of Duke University by obtaining the written permission of the course instructor and the dean for continuing education and by paying the current audit fees. House staff members are not permitted to take courses offered through the division of undergraduate medical education. For more information, please contact Dr. Judith Ruderman, Academic Dean for Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708, (919) 684-6259.

## Postgraduate Education

**Continuing Medical Education.** Since their inception, Duke University Medical Center's School of Medicine and Hospital have made education a part of their core missions. In their commitment to the training of health care professionals, the university's medical institutions have emphasized the crucial relationship between the enthusiastic pursuit of knowledge and excellence in the practice of medicine. Continuing medical education programs sustain this pursuit and acknowledge its lifelong importance in helping health professionals maintain the highest possible standards of care.

*Mission.* Duke University Medical Center assumes a responsibility for the ongoing education of physicians and other health professionals and through continuing medical education strives to maintain without interruption the process of learning begun in undergraduate and graduate medical education. Within the Duke University School of Medicine, the Office of Continuing Medical Education (CME) has been charged with the responsibility of implementing the institution's commitment to continuing medical education.

The chancellor appoints the associate dean of continuing medical education who reports to the dean of medical education. The associate dean has overall responsibility for the Office of CME, providing leadership, liaison, and recommendations for departmental and institutional CME activities. To assist the associate dean and to provide for a close connection with individual medical departments, the department chairs and the medical dean appoint a committee composed of representatives from the departments, special divisions, and special areas of the Medical Center. This committee acts in an advisory capacity regarding policies and procedures for the development of continuing medical education within the School of Medicine and the Medical Center.

The Office of Continuing Medical Education has the following responsibilities which it meets with the aid of the committee:

1. Initiate CME activities in cooperation with departments of the Duke University Medical Center, the Office of Medical Alumni Affairs, and other appropriate organizations within the institution that embrace the CME commitment to alumni and practicing clinicians in the state, region, and nation;
2. Maintain a process of continuing assessment of the needs of health professionals;
3. Maintain Duke University's national CME accreditation;
4. Offer CME credit for activities which meet CME guidelines;
5. Monitor the development of CME activity and its execution in response to the needs of practicing physicians;
6. Maintain a record of CME credits issued to participants at activities approved by Duke University School of Medicine;
7. Provide guidelines, recommendations, and support for new and innovative CME activities;
8. Advise on the development of CME policies and procedures and,



9. Seek new sources of additional support for CME programming and development.

Numerous formal postgraduate courses are given throughout the year for physicians in general practice as well as in all specialties. Conferences and tutorial seminars are also available to any physician who desires to attend and participate. Physicians in practice may make arrangements for a period of one day or more for courses tailored to their particular interests. These personal contacts with senior faculty and residents, including patient examinations as well as follow-up care help provide in-house training experience.

For additional information, please contact the Office of Continuing Medical Education, Duke University Medical Center, Box 3108, Durham, North Carolina 27710, (919) 684- 6878 or toll free 1-800-222-9984.

*Student Life*

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## **The University**

Duke University, located in Durham, North Carolina, has an enrollment of 11,611 students from all fifty states and from many foreign countries. Currently, Trinity College of Arts and Sciences, the Graduate School, and the Schools of Business Administration, Divinity, Engineering, Environment, Law, Medicine, and Nursing comprise the university.

Durham, with a population of 148,000, is in the Piedmont region of North Carolina and has easy access to the sea coast and mountains. It is one of the three cities bounding the Research Triangle Park where numerous private research laboratories and governmental agencies are located. Duke University is twenty-five miles from North Carolina State University in Raleigh, eight miles from the University of North Carolina at Chapel Hill, and is in the same city as North Carolina Central University.

## **Conduct of Students**

Duke University expects and requires of all its students cooperation in developing and maintaining high standards of scholarship and conduct.

All students are subject to the rules and regulations of the university which are currently in effect or which, from time to time, are put into effect by the appropriate authorities of the university.

Any student, in accepting admission, indicates the willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university.

## **Living Accommodations**

Duke University has two residential apartment facilities in which graduate and professional students live. These apartments are available for continuous occupancy throughout the calendar year. All the apartments are completely furnished by the university. An itemization of furnishings is included with the floor plans sent out in the application packet.

Spaces in apartments for single students are provided on an individual basis with each student paying rent per academic term to the university. This method permits students to share apartments with others of their choice. When this is impractical, the



Department of Housing Management strives to place persons with similar interests together.

**Town House Apartments.** Town House Apartments, located about three blocks from the main East-West Campus bus line, is a thirty-two-unit complex. These apartments are more spacious than most apartments found on campus or in Durham. Because of its location away from the academic facilities, students find that these apartments offer a change from normal campus life and activities.

Each air-conditioned apartment includes a living room, a master bedroom, a smaller bedroom, a bath and a half, and an all-electric kitchen with a dining area. Spacious closets and storage spaces are provided within each apartment. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months.

Occupants must make arrangements with the local telephone company, GTE, to pay for telephone service. GTE usually requires a deposit when initial application for service is made. The company should be contacted prior to arrival as it usually takes several days to obtain service.

**Central Campus Apartments.** During 1975, Duke University completed a 500-unit apartment complex.

A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months. Additional facilities include a pub, convenience store, tennis courts, and basketball courts.

All utilities—water, heat, air-conditioning, and electricity—are provided. Telephone jacks are provided in each apartment. Duke University's Tel-Com supplies telephone service. Central Campus Apartments residents are responsible for providing their own phones and having them connected.

Efficiency, two-bedroom, and three-bedroom apartments are rented to graduate students. Efficiency units are very limited in number and are not generally available to new students.

**Application Procedures.** When students are informed of their acceptance to the Medical School they will also receive a postcard on which to indicate preference for university housing. This postcard should be returned to the Department of Housing Management. Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. Assignment to all university housing is made on a first-apply, first-assigned basis, and it is not guaranteed.

**Off-campus Housing.** The Department of Housing Management maintains a listing of rental apartments, rooms and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid students in their attempt to obtain housing off campus. Information on commercial complexes in the Durham area may be obtained by indicating a preference for off-campus housing on the postcard which you will receive with your acceptance notice. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the university nor its agents negotiate between owners and interested parties.

The search for accommodations should begin as soon as possible after acceptance to the Medical School. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the availabilities.

**Dining Facilities.** In addition to the Medical Center cafeteria, a number of dining facilities are located within a short distance from the Medical Center. Duke Dining Services operates a variety of dining facilities, including a coffee cart, an all-you-can-eat cafeteria, several a la carte restaurants, and fast food facilities. The many dining locations on campus give Duke students virtually unlimited dining options. For more information

about campus dining options, contact Dining Services at 029 West Union Building, Box 90898, Durham, NC 27708-0898, 919/660-3900.

## Services Available

**Student Personal and Professional Advisory Program.** One important objective of Duke University School of Medicine is to promote an informal, cordial student-faculty relationship. It is also felt that this type of relationship will promote better curriculum advising and career advising for the student. Each entering student is assigned to one of four advisory deans, who oversees his/her academic progress and with whom the student will meet in small groups and individually for personal advising, curriculum planning, and career counseling. A full-time associate dean is available to students for personal and crisis counseling or referral on a strictly confidential basis.

**Student Health Service.** The Student Health Service is administered by the Department of Community and Family Medicine, Duke University Medical Center. Medical services are provided by board-certified faculty and by physician assistants, nurse practitioners, and resident physicians under faculty supervision.

**Duke Family Medicine Center.** The DFMC (684-6721), located on the corner of Erwin Road and Trent Drive in the Marshall Pickens building, is the primary location for medical care. Students are seen by appointment Monday-Friday, 7:00 a.m.-7:30 p.m., Saturdays from 10:00 a.m.-1:30 p.m., and Sundays from 2:00 p.m.-4:30 p.m. A wide variety of services are available: general medical care, health education, sports medicine, laboratory, pharmacy, travel and immunization, x-rays, cold/flu self-help table, allergy clinic, and nutrition counseling.

Students are encouraged to use the Duke Family Medicine Center as their portal of entry to other health resources when needed, including the specialty clinics at Duke University Medical Center. This will help with coordination of appropriate care.

For problems arising after hours, students should call the Infirmary (684-3367). After consulting with the physician on call, the nurse may advise the student to come to the Infirmary or to the Duke Emergency Department (684-2413) for further evaluation. In the event of an obvious life-threatening emergency, students should go directly to the Emergency Department. If necessary, Duke Public Safety (call 911 or 684-2444) will provide on-campus transportation to the Emergency Department or the Infirmary.

**The Infirmary.** The Infirmary (684-3367), located on the fourth floor of Duke University Hospital South Division, purple zone, provides inpatient treatment of illnesses too severe to manage in the residence hall or apartment, but not requiring hospitalization.

**Health Education.** This component of the Student Health Service is headquartered at Trent Drive Hall, and at the Healthy Devil Health Education Center in House 0 on West Campus. Health education staff are available to assist students in making informed decisions that promote their health. Topics of concern include alcohol and other drug usage, eating and nutrition, sexual activity and sexually transmitted diseases, stress management, and others.

**Sports Physical Therapy.** The Student Sports Physical Therapy Clinic is located on West Campus, in the basement of Card Gym. A physical therapist is available from 3:00-6:00 p.m. weekdays, on a walk-in basis, to assess exercise-related problems, and to outline short-term treatment plans to aid recovery, and help prevent re-injury. Sports Medicine consultation is available by referral.

**Confidentiality.** Information regarding the physical or mental health of students is confidential, released only with the student's permission.

**Health Fee.** All currently enrolled full-time students and part-time degree candidates are assessed a mandatory student health fee. This covers most services rendered within the Student Health Service (see below) during each enrolled semester. An optional summer health fee for students not enrolled in summer sessions is also available through the bursar's office.

Health insurance is essential to protect against the high cost of unexpected illnesses or injuries which would require hospitalization, surgery, or the services of specialists outside the Student Health Service. All students are required to have such insurance. For those not adequately covered by other insurance, the Duke Student Insurance Plan is specifically designed to complement the coverage provided by the student health fee. Coverage for the student's spouse and dependent children may be purchased. Further information about this plan may be obtained from Hill, Chesson, and Associates (489-7426).

**Services Covered by the Health Fee.** The health fee covers most of the services at Duke Family Medicine Center if medically indicated and rendered by a student health provider:

- medical care for acute and chronic illness, and minor injuries
- one annual health maintenance examination and most associated studies
- most routine laboratory and x-ray services
- confidential pregnancy testing
- most medications required for short-term treatment of acute problems
- immunizations required for programs receiving academic credit at Duke (note: a supplemental fee may be required for certain immunizations), excluding prematriculation immunizations

The health fee covers a variety of other services at DFMC and other locations:

- health education and health promotion including nutrition consultation
- sports medicine, not including specialists' (orthopaedic) services
- infirmary service, not including meals and not including diagnostic testing ordered by specialist consultants
- mental health and career counseling at CAPS

**Services not Covered by the Health Fee.** If you are unsure whether a service is covered, please ask the staff of the Duke Family Medicine Clinic business office prior to receiving the service. You are financially responsible for the following:

- medical care provided in the Emergency Department, hospital, or other non-student health facility
- care provided by specialist consultants, including those working within the student health facilities
- dental care
- pregnancy care or deliveries
- tests, procedures, prescriptions not medically indicated, not on the approved list, or not ordered by student health providers
- immunizations required for entrance to Duke or other universities, or for personal travel
- medications not on the student formulary and those required for long-term use; contraceptives

Upon arrival on campus, all students receive a description of the program and the services covered by the student health fee.

Student Health Service, William A. Christmas, M.D., *Director*, 144 Trent Hall

**Counseling and Psychological Services.** Counseling and Psychological Services (CAPS) is located in Suite 214, Page Building on West Campus. CAPS is a component of student services which provides a comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students.



The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with young adults. They provide direct services to students including evaluation and brief counseling/psychotherapy regarding a wide range of concerns. These include issues of self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. Ordinarily students are seen for counseling by appointment. If your concern requires immediate attention, a CAPS staff member will assist you with the emergency at the earliest possible time.

Each year CAPS offers a series of self-development seminars and support groups. These explore such interests as stress, relationships, awareness of diversity, and management of eating disorders. Support groups for graduate and professional school women, international students, and gay and lesbian students have been developed. Interested students may contact CAPS for further information.

Another function of CAPS is to provide consultation regarding student development and mental health issues affecting not only individual students but the campus community as a whole. The staff works with other campus personnel including administrators, faculty, the student health staff, and student groups in meeting needs identified through such liaisons.

## Student and Professional Organizations

**Alpha Omega Alpha.** Alpha Omega Alpha Honorary Medical Fraternity was founded in 1902 and the Duke University chapter, Alpha of North Carolina, was chartered in 1931. The society works to promote scholarship and research in medical schools as well as high standards of character and comportment toward patients among students and physicians. AOA elects to its membership students who have exhibited academic promise, clinical excellence, and leadership. Membership is limited to one sixth of each graduating class, and up to half of these may be elected in the junior year. AOA membership is also conferred upon physicians, including alumni and faculty members, who have distinguished themselves in research, teaching, and practice.

Duke University Chapter Councillor: Harvey J. Cohen, M.D.

President: Robert Dow Hoffman

Vice-President: Kimberly Ann Bazar

**Davison Society.** All medical students are dues-paying members of the Davison Society, named for the first dean of Duke Medical School. The society is governed by the Davison Council which consists of elected officers (president, service vice-president, social vice-president, secretary, treasurer, and intramural sports chairman) and elected representatives from each class. Primary responsibilities of the council include: chartering of medical student groups, budgeting funds for student groups and medical school activities, organization of medical school activities and social events, appointment of medical students to Medical Center and university committees, and representing student views to the pertinent faculty and administration. The Davison Council also coordinates medical student projects with community service groups such as Adopt-A-Highway, Habitat for Humanity, Share Your Christmas, Durham City Schools Seventh Grade Sex Education Program, AIDS Volunteer Network, Durham Community Kitchen, and the North Carolina Museum of Life and Science Saturday Science Program.

Medical student groups affiliated with, and in the past funded by the Davison Society include: the American Medical Student Association, the North Carolina Student Rural Health Coalition, the North Carolina Medical Society Student Chapter, the Student National Medical Association, *Shifting Dullness* (the medical student newspaper), Christian Medical and Dental Society.

Also: Children's Miracle Network Auction, Computer Interest Group, Student Curriculum Committee, Duke Comprehensive Cancer Center Volunteer Program, Family Medicine Interest Group, Pediatric Cardiology Volunteer Program, Self Defense Workshop, the *Aesculapian* (yearbook), and Women in Medicine.

Meetings of the council are open to all students and minutes of council meetings are posted. The members of the council are elected in the spring of each year except for the first year class representatives who are elected during the first fall after matriculation. An annual formal, the Davison Ball, is held in the spring.

**The Engel Society.** The Engel Society, established in 1966 as a memorial to Professor Frank L. Engel, is designed to promote intellectual and social interaction between students and faculty. Membership is limited to six junior students and six senior students who have demonstrated an inquisitive nature, humanitarian interests, and high scholastic ability. Four faculty members are selected annually by members of the society for three year terms. Six dinner meetings with guest speakers are held each year. Other students may be invited to participate.

Engel Society Moderator: Delbert L. Wigfall, M.D., Box 3959, Duke University Medical Center, Durham, North Carolina 27710.

**Duke University Medical Alumni Association.** The Duke Medical Alumni Association consists of over 9,000 members including all graduates of the Medical School, all past and present house officers, and the faculty of Duke University Medical Center. November reunions are held each year in Durham and regional functions are sponsored for alumni throughout the country. Social functions and programs for medical students are sponsored annually, as is a student seminar and the Candy Jar. The Medical Alumni Association maintains a listing of alumni willing to host students in their local area. *Perspectives* magazine and *Medical Alumni News* update alumni about their classmates as well as the latest DUMC happenings quarterly.

President: Joseph E. Walker, '51, M.D. '60, Shelby, North Carolina;

President-Elect: Edward G. Bowen, '57, M.D. '59, HS '59, Atlanta, Georgia;

Vice President: David K. Wellman, M.D. '72, HS '72-73, '75-'78, Durham, North Carolina;

Secretary: Alan D. Davis, M.D. '75, Plano, Texas;

Treasurer: Nicholas Georgiade, M.D. '50, HS '59-54, Durham, North Carolina;

Historian: Jay M. Arena, M.D. '32, HS '33-35, Durham, North Carolina;

Ruth A. Irvin, Director, Annual Giving and Alumni Programs.

## Awards and Prizes

**Allen Travel Award.** Dr. Susan Allen (Duke alumna) has provided funds to assist a third or fourth year student in traveling to Africa for research/study of health care. Selection of an appropriate student is made by the dean; award may be up to \$1,500.

**Davison Scholarship.** The Davison Scholarship award, consisting of \$2,000, is supported by the Davison Club in the memory of Dean Davison to enable a medical student to participate in a clinical science elective outside the United States in an area of primary care. Any student eligible to study away may apply for the award. For consideration for the scholarship, the elective must be approved by the Study Away Committee.

**Thomas Jefferson Award.** This award, consisting of \$100, a certificate, and a book recognizes a graduating senior student who has made outstanding contributions to the university or to fields which have not been traditionally confined to science and medicine. The award is given by the Awards Committee to a graduating senior.

**The Joseph Eldridge Markee Memorial Award in Anatomy.** This award, donated by the friends and family of the late Dr. J. E. Markee, James B. Duke Professor of Anatomy and chairman of the Department of Anatomy from 1943 to 1966, consists of a certificate, medallion, and cash award of \$200. It is presented by the Department of Anatomy to the most outstanding student in anatomy during the first year in the Medical School.

**C. V. Mosby Book Award.** Three graduating senior students are selected by the Awards Committee for active participation in service to the students, community, and medical school. The award is a Mosby book of the student's selection.

**E. Eugene Owen, M.D. Clinical Awards.** Four graduating seniors are selected for a cash award based on excellence in the clinical sciences in the second and fourth years. The Owen Award honors Dr. E. Eugene Owen, a distinguished diagnostician of the Watson Clinic in Lakeland, Florida. The Watson Clinic Foundation makes these annual awards.

**Trent Prize.** An annual award of \$100 is given to a Duke medical student for the best essay on any topic in the history of medicine and allied sciences. Mary Trent Semans established this award in memory of the late Josiah C. Trent to encourage students to undertake independent work in the history of medicine and to utilize the resources of the Trent Collection.

**Upjohn Award.** The award consists of \$200 cash and a certificate and is presented to a Duke graduating senior for excellence in community health science projects and service to the community.

**Sandoz Award.** This award is given to a senior student who has done distinguished work in basic science research or clinical research. Students will be nominated for this award by departmental chairmen with whom their work has been done. The work must have been presented at the AOA symposium and voted upon by the Awards Committee. It consists of a plaque and a check for \$100 and is limited to one student.

**Ciba Award.** This award is given to a third year student who has contributed to the health care of the community. Students are nominated by the student body and voted upon by them. The award consists of the complete set of medical illustrations and text by Frank Netter.

**Other Awards.** Throughout the year, Duke Medical School receives notification of awards consisting of books, money, and/or plaques or medals to be awarded to students in a variety of fields at all medical schools on a national competitive basis selected by committees of the sponsoring organizations. These awards are screened by the dean's office and publicized appropriately.



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## *Admissions*



## Admission Procedures

Good study habits, intelligence, character, and integrity are essential qualifications for admission. Beyond this, premedical students should strive for an education that develops abilities to observe critically, think analytically, and work independently. Though a knowledge of basic scientific principles should be secured, the competence with which premedical students conduct their undergraduate careers is of more importance than the specific subjects which they study.

**Application for Admission.** The Duke University School of Medicine participates in the American Medical College Application Service (AMCAS). Application materials may be obtained from a premedical adviser or by writing: American Medical College Application Service, Association of American Medical Colleges, Suite 201, 2450 N Street, N.W., Washington, DC 20037-1131.

Upon receipt of the application materials from AMCAS, if credentials indicate, a supplemental application and other information will be mailed which will serve as notification of receipt of the application from AMCAS. Applications are received by AMCAS any time after 15 June until 15 October. Applicants are urged to file their applications as early as possible. Supplemental application should be returned within two weeks of receipt by the applicant.

Upon receipt of the supplemental application, two faculty members will determine whether or not to proceed with an interview.

**Requirements.** Admission to the School of Medicine requires a minimum of ninety hours of approved college credit including one year of college English or a university writing course, one year of inorganic chemistry, one year of organic chemistry, one year of physics, one year of biology and/or zoology, and one year of calculus. An introductory course in biochemistry during the senior year would be helpful. All science requirements must be completed not more than seven years prior to entrance.

The Medical College Admission Test, administered by the American College Testing Programs and Services, P.O. Box 414, Iowa City, Iowa 52240, is required of all applicants. This test is given in April and September of each year at numerous colleges throughout the United States. If possible, students should arrange to take this test in April of the year they plan to submit applications for admission. MCAT scores dated earlier than four years prior to the year applied for will not be considered.



## **Selection**

The earliest date of notification of acceptance is in February for students entering the following August. Data on each candidate are screened using a computer model of our matriculated students. Those selected to receive a supplemental application are carefully evaluated by the Committee on Admissions. A personal interview will be conducted at Duke for those students with satisfactory credentials. Candidates may have personal interviews with regional representatives of the Admissions Committee. Those candidates who demonstrate the most promise for exceptional performance in their future practice of medicine are admitted on the basis of merit. In order to ensure enrollment, accepted candidates must return a signed agreement within three weeks after notification. Since admission is offered in advance of matriculation, it is provisional upon the successful completion of any incomplete premedical required subjects as well as the continued demonstration of scholarship in college course work.

## **Transfer**

Duke University School of Medicine does not accept transfer students except in unusual circumstances.

## **Advanced Placement**

Students who have been awarded Ph.D. degrees in biomedical or preclinical sciences may apply, after acceptance to the School of Medicine, to be considered for a three-year program to obtain their M.D. degrees. This program consists of the core basic science courses required of all freshman medical students, core clinical rotations during the second year, followed by senior clinical electives. Students whose Ph.D.'s have not been awarded prior to expected matriculation are not eligible for this program. Students



must complete all Ph.D. requirements prior to matriculation if application is made while still in graduate school.

## Reapplication

Students who wish to apply for a second time should write AMCAS requesting new application forms. Supporting documents are transferred to the new application file. These documents are kept on file for three years. To be seriously considered, reapplicants must have made significant additions of experience or coursework to their original application.

## Summary

Three years of college work, a fifty-five dollar (\$55) nonrefundable application fee, a signed agreement within three weeks of notification of acceptance, and the Medical College Admission Test are required. The estimated class size in 1994-95 freshman class is 100.

### Roster of Regional Representatives of Admissions Committee

Alabama:	<i>Birmingham</i> , Margaret M. Tarpey
Arizona:	<i>Tucson</i> , Ruth H. Capp, David S. Shimm
Arkansas:	<i>Little Rock</i> , E. Clinton Texter, Jr., Larry W. Williams
California:	<i>Artesia</i> , Garrett F. Saikley; <i>Burlingame</i> , J. M. Javer, Andrew Nadell; <i>Carmichael</i> , John R. Dein; <i>Fairfield</i> , William R. Nesbitt; <i>Fontana</i> , Henry L. Burks; <i>Irvine</i> , A. Brian Davis; <i>La Jolla</i> , Herman F. Froeb; <i>Los Angeles</i> , Walter Lusk, Douglas F. Smiley; <i>Redlands</i> , Perry Dyke; <i>Redwood City</i> , John B. Simpson; <i>Sacramento</i> , Sidney M. Gospe, Jr.; <i>San Diego</i> , Lars Erickson, Stuart B. Kincaid, Robin E. Rutherford, Donald J. Williams; <i>San Francisco</i> , Robert Kahn, R. Gray Patton, Henry Safrit; <i>Santa Monica</i> , Kenneth P. Ramming; <i>Walnut Creek</i> , David S. Forth
Colorado:	<i>Denver</i> , Frederick L. Grover, Michael J. Jobin, York E. Miller; <i>Englewood</i> , Bertram Goldberg
Connecticut:	<i>New Haven</i> , G. P. Beardsley, David J. Goodkind, Stephen J. Huot
District of Columbia:	Jonca C. Bull, Linda D. Green, Kurt D. Newman
Florida:	<i>Gainesville</i> , Jerry Berger, Timothy R. S. Harward, Alan Klein, Steve Roark; <i>Hallandale</i> , Norman Moskowitz; <i>Miami Beach</i> , Stephen W. Unger; <i>South Miami</i> , Leonard A. Kalman; <i>Tampa</i> , Richard G. Connor, Americo A. Gonzalvo, Douglas Reintgen
Georgia:	<i>Atlanta</i> , R. Wayne Alexander, Crawford F. Barnett, Jr.
Hawaii:	<i>Honolulu</i> , Stanley Karansky, John Mickey; <i>Kealahou</i> , Thomas E. Austin; <i>Wahiawa</i> , Ned Stoughton
Illinois:	<i>Barrington</i> , George Pepper; <i>Chicago</i> , John H. Buehler, Herbert Engelhard, George H. Gardner, Daniel J. Pachman, John D. Utley; <i>Elk Grove Village</i> , Gary E. Kay; <i>Geneva</i> , Charles A. Hanson; <i>Park Ridge</i> , Earl N. Solon
Indiana:	<i>Indianapolis</i> , C. Conrad Johnston, Jr.
Kansas:	<i>Lenexa</i> , David L. Smith
Louisiana:	<i>Baton Rouge</i> , Karen H. Miller; <i>New Orleans</i> , Nancy Haslett



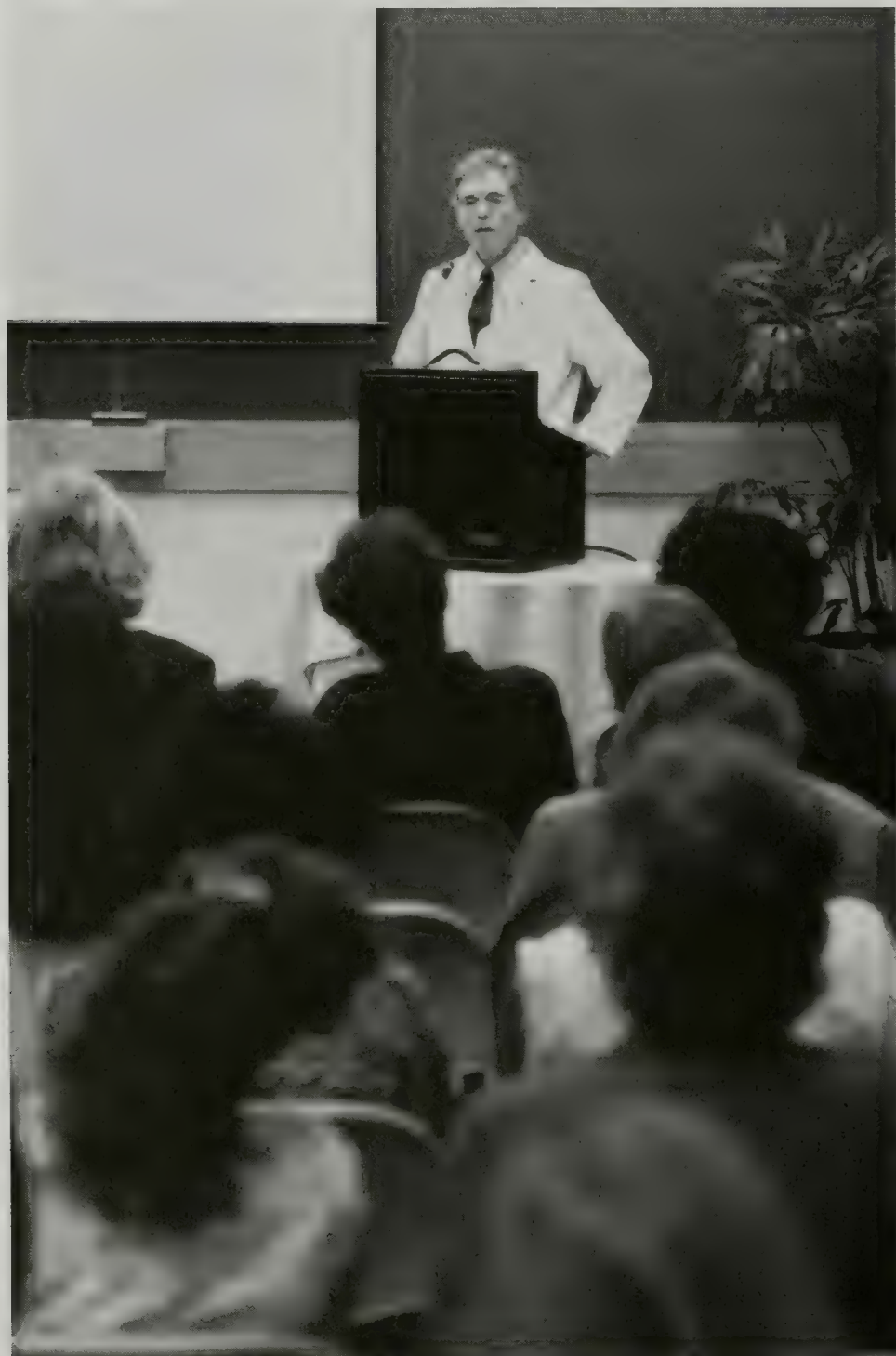
- Maryland: *Olney*, Joseph Buffington; *Reisterstown*, William F. Casano
- Massachusetts: *Arlington*, K. Lea Sewell; *Boston*, Ann W. Crosson, Matthew W. Gillman, Paula Kadison, Richard Kopelman, Brit Nicholson, Stephen A. Sohn; *Brockton*, Desiree Carlson; *Brookline*, Jayne Trachman; *Cambridge*, Paul N. Chervin; *Hyannis*, Linda A. Bishop; *Natick*, Gregg C. Checani; *Newton Centre*, Bernard Levy; *Wellesley*, George King; *Worcester*, Katherine S. Upchurch
- Michigan: *Detroit*, John J. Fath; *Flint*, Melissa Hamp; *Grosse Pointe*, John M. Lesesne
- Minnesota: *Lauderdale*, Christian T. Campos; *Minneapolis*, James Halikas
- Missouri: *Kansas City*, Gerry Woods; *Springfield*, C. Norman Shealy; *St. Louis*, Scott J. Anderson, W. Edwin Dodson; *Webster Groves*, Julia L. Stevens
- Nebraska: *Omaha*, Linda K. Matson
- New Hampshire: *Concord*, Joseph R. Snow; *Portsmouth*, Eric D. Lister
- New Jersey: *Hackensack*, Steven P. Honickman; *Moorestown*, Michael S. Entmacher; *Morristown*, Neal D. Shore; *Pompton Plains*, Charles W. Ross; *Princeton*, Timothy Patrick-Miller; *Summit*, Wayne S. Barber; *Watchung*, R. Christopher Stucky
- New York: *Bronx*, Steven R. Savona; *Ithaca*, John G. Maines; *New York*, David S. Goldman, Bruce Horten, Lenard E. Jacobson, Cynthia L. Krause, Michael J. Lepore, Nathan St. Amand, David N. Silvers; *Rhinebeck*, Catherine Toye; *Rochester*, Phyllis C. Leppert, Douglas K. Slater

Ohio:	<i>Akron</i> , Robert W. Novak; <i>Cincinnati</i> , Donald Rucknagel; <i>Cleveland</i> , Stephen E. Alpert; <i>Columbus</i> , Miles E. Drake, Jr.; <i>Elyria</i> , William L. Hassler
Oklahoma:	<i>Oklahoma City</i> , James R. Gavin III, Richard L. Reece; <i>Tulsa</i> , James A. Young
Oregon:	<i>Portland</i> , Marcia Freed
Pennsylvania:	<i>Johnstown</i> , W. Frederick Mayer; <i>Philadelphia</i> , Christopher V. Chambers, Mary Ann Forciea, John J. Furth, David M. Goodner, James R. Harp, Richard I. Katz, Sheila M. Katz, Graham E. Quinn, Mona M. Shangold; <i>Pittsburgh</i> , Richard L. Green, Martin A. Morse, Michelle Roberts; <i>Rydal</i> , Anthony J. Limerakis; <i>State College</i> , Richard H. Dixon, Donald F. Mandetta; <i>Wallingford</i> , Cathy Wiley, Jim Wiley; <i>Wynnewood</i> , Frank Kern
Rhode Island:	<i>Lincoln</i> , Henry G. Magendantz; <i>Providence</i> , Benjamin T. Jackson
South Carolina:	<i>Columbia</i> , Ben Miller
Tennessee:	<i>Chattanooga</i> , Roger G. Vieth; <i>Memphis</i> , Peter D. Jones; <i>Nashville</i> , Alexander C. McLeod
Texas:	<i>Dallas</i> , Paul Pin, William Shapiro; <i>Galveston</i> , J. Andrew Grant, Jr.; <i>Houston</i> , Robert B. Bressler, Madeline Duvic, Kenneth Gould, Jr., Barry N. Hyman, Eugenia Kleinerman, Leonard A. Zwelling; <i>Plano</i> , Alan D. Davis
Utah:	<i>Salt Lake City</i> , Ralph Whatley
Vermont:	<i>Norwich</i> , John Modlin
Virginia:	<i>Alexandria</i> , Andrea M. Jackson; <i>Falls Church</i> , Thom A. Mayer
Washington:	<i>Auburn</i> , Joseph Gehrett; <i>Kirkland</i> , David Pitkethly; <i>Renton</i> , Wallace H. J. Chang; <i>Seattle</i> , Gregory J. Raugi; <i>Woodinville</i> , Alice M. Ormsby



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## *Financial Information*



## Fees and Expenses

**Tuition Policy Statement.** The Duke University School of Medicine's mission in medical education is to build upon our internationally-recognized tradition of excellence in training outstanding practitioners and physician-scientists who will be leaders in all fields of medicine. By selecting outstanding and dedicated students for matriculation, the school is committed to preparing physicians to respond to societal health needs. The school of medicine has a policy of need-blind admission and adequate financial aid for those students with financial need. Tuition is set at a level which is competitive with schools of comparable quality and selectivity for admission. This tuition policy plus a financial aid program which protects against excessive student indebtedness permits the school of medicine to attract the most qualified students nationally and regionally regardless of the student applicant's personal or family financial status. It is important that tuition and financial aid are balanced to ensure that debt does not skew career choices of medical students once they graduate from the medical school.

**Tuition.** The following table represents an estimate of a student's necessary expenses in the School of Medicine. The total of these figures suggests a basic minimum budget of approximately \$36,000. These are estimated figures only. Tuition and fees are subject to change without notice. Allowances for recreation, travel, clothing, and other miscellaneous items must be added to this estimate with allowances for individual needs and tastes.

Tuition Year 1	\$22,400
Tuition years 2, 3, and 4	\$20,500
Accident and Sickness Insurance+ (subject to change)	618
First Year Fee+ (includes microscope rental, first year only)*	275
Annual Cost of Books and Supplies: first year	2,066
Annual Cost of Books and Supplies: second year	1,405
Annual Cost of Books and Supplies: third and fourth year	626
Lodging	3,992
Board: first year	3,194
Board: second year	4,065
Board: third and fourth year	2,322
Student Health Service+ \$192 per semester	384
Student Government+ (Davison Society)	50
Continuation of Enrollment Fee‡	35
Graduate Student Fee+	10
Motor Vehicle Registration	120

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\*Sphygmomanometer, ophthalmoscope, otoscope, and other equipment required of each student must conform to rigid standards.

+Mandatory fees.

‡The School of Medicine encourages students to interrupt their studies to pursue approved educational endeavors complementary to the medical curriculum at Duke or elsewhere for no credit. To retain full-time student status for loan deferment purposes, students may seek approval to enroll in the Continuation of Enrollment option. Only students eligible to be enrolled at Duke during the applicable time period may participate.

Tuition and fees are payable on a semester basis and all students are required to pay full tuition for four years as a requirement for graduation. For the freshman year, one-half of the annual tuition and fees is billed in July and the other one-half in December. Students who must repeat 60 percent or more of the required first year courses pay full tuition while prorated tuition is paid by those repeating less than 60 percent of those courses. Second year students are billed at the rate of one-seventh of the annual tuition and fees for the Introduction to Clinical Medicine and each eight-week rotation and one-fourteenth of the annual tuition and fees for each four-week rotation. (The six-week psychiatry rotation and the two-week cost effective care rotation are billed as one eight-week block.) Juniors and seniors are billed for a total of sixty-four credits during the elective years. Distribution of tuition charges depends upon the number of credits for which a student is registered each term. Cost per credit is obtained by dividing the annual tuition by thirty-two, half the number of elective credits required for graduation. No tuition is charged for elective credit taken in excess of the sixty-four required to obtain the M.D. degree provided the credit is taken within the same semester in which the student completes graduation requirements. Please note, however, that the student is no longer eligible to receive financial aid funding after he or she has completed the sixty-four (seventy-two\*) elective credits.

**Payment of Accounts for Fall and Spring.** Monthly invoices for tuition, fees, and other charges are sent by the bursar's office and are payable upon receipt but no later than the late payment date. As a part of the agreement of admission to Duke University, a student is required to pay all invoices as presented. No deferred payment plans are available. If full payment is not received by the late payment date, a late payment charge as described below is assessed on the next invoice and certain restrictions as stated below are applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. Nonregistered students are required to make payment at the time of registration for tuition and fees and any past due balance on the account.

**Late Payment Charge.** If the "Total Amount Due" on an invoice is not received by the late payment date, the next invoice shows a penalty charge of 1 1/4 percent per month assessed on the past due balance regardless of the number of days past due. The "Past Due Balance" is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loan memo credits related to the previous balance which appear on the invoice. The amount of the 1 1/4 percent penalty charge is the same regardless of the number of days payment is received after the late payment date.

**Restrictions.** An individual is in default if the total amount due is not paid in full by the due date. A student in default is not allowed to register for classes, receive a transcript of academic records, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school and have the account referred to a collection agency. If an account is referred to a collection agency, the individual is responsible for all applicable collection and/or court costs.

No credit is given for any term in which the tuition has not been paid, whether the work has been at Duke or elsewhere. It is not advisable for students to attempt outside work to defray their expenses during the academic year. Spouses of medical students desiring employment may secure information from the Duke University Personnel Office.

**Fall and Spring Refunds.** Tuition and fees refunds are governed by the following policy:

1. In the event of death a full tuition and fees refund will be granted.

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\* Applies to students beginning elective requirements prior to fall semester, 1993.



2. In all other cases of withdrawal or leaves of absence, students or their parents may elect to have tuition refunded or carried forward as a credit for later study according to the following schedule:
  - a. withdrawal before the beginning of classes—full refund;
  - b. withdrawal during the first or second week—80 percent;
  - c. withdrawal during the third through fifth week—60 percent;
  - d. withdrawal during the sixth week—20 percent;
  - e. withdrawal after the sixth week—no refund;
  - f. tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward.
3. In the case of changing category from full-time to part-time, dropping special fee courses (music, art, golf, etc.), or dropping audit courses, a full refund is granted during the drop/add period. Subsequent to the drop/add period changes of category are not allowed. Students may, however, withdraw from courses after the drop/add period with no refund or add new courses if the proper tuition is paid.

Because Duke University participates in Title IV federal aid programs, it follows federal guidelines with respect to the refund and repayment of these funds. All first time students who withdraw within 60 percent of the enrollment period will have their charges and financial aid adjusted according to the federal regulations. Additional information regarding this procedure may be obtained from the Office of Financial Aid.

**Continuation of Enrollment Fee.** The School of Medicine encourages students to interrupt their studies to pursue approved research that is complementary to the medical curriculum either at Duke or elsewhere for no credit. Full-time student status can be retained for a maximum period of two years during these periods of study if approval is obtained from the appropriate officials and the student registers for and pays an enrollment fee of \$35 for each semester or part of a semester away. No refund of any portion of the fee is allowed for students who subsequently withdraw from the School of Medicine.

Although considered to be full-time by the Duke School of Medicine, financial aid recipients should be aware that such status may not be recognized by lenders for loan deferment purposes.

Only students eligible to be enrolled at Duke during the applicable time period may participate in this option.

**Transcripts.** Requests for transcripts of academic records should be directed to the Office of the Medical Center Registrar. A fee of three dollars, payable in advance, is charged for each copy. However, the transcript fee is waived for financially needy students who require transcripts to apply for external funding. After graduation from the School of Medicine, transcripts of deans' letters may also be obtained from the Office of the Registrar for the fee of one dollar per copy.

## Living Accommodations

**Housing Costs.** For the 1994-95 academic year, rental rates for the first-year medical student are projected to be \$3,729 for the Town House apartments. Utility charges, except telephone, were included in these rates. Rates for the 1995-96 academic year were not established in time for publication in this bulletin.

Rental rates in Central Campus Apartments for the 1994-95 academic year ranged from \$3,165 to \$4,891 for first-year medical students. Utility charges, except telephone, were included in the Central Campus Apartment rates. Rates are per person per academic year. Rates for the 1995-96 academic year were not established in time for publication in this bulletin.



A deposit is required with all applications. The deposit is not refunded if cancellation is received after an assignment is made.

Refunds of rent are calculated in accordance with the procedures published by the Department of Housing Management.

**Food and Other Expenses.** Duke Dining Services and Duke University Store operations are located on campus to service the needs of the Duke community. For the convenience of students, the university identification card, called The DukeCard, can be used to access prepaid accounts and make purchases in these facilities.

There are two kinds of accounts: the dining account, which can be used for food purchases only, and the flexible spending account, which can be used to purchase not only food, but any items sold by Duke stores, such as books, supplies, laundry services, health and beauty aids, and more. These campus retail operations also accept cash.

For more information about establishing an account, contact The DukeCard Office, 024 Union West, Box 90911, Durham, North Carolina 27708-0911, 919/684-5800.

## Motor Vehicle Registration

Each motor vehicle operated on Duke University campuses by students enrolled in the School of Medicine must be registered at the Medical Center Traffic Office, PRT Level, Parking Deck II, within five days after operation on the campus begins, and thereafter must display the proper registration decal.

All students must pay an annual fee of \$50 for each four-wheeled motor vehicle and \$50 for each motorbike or motor scooter registered. Bicycles are registered free of charge at the Public Safety Department, 2010 Campus Drive.

To register a vehicle, the student must present a valid state registration for each vehicle registered and a valid state operator's license.

Parking, traffic, and safety regulations are given each student at the time of registration of the vehicle(s). Students are expected to abide by these regulations.

## Merit Awards for Medical Students

The School of Medicine offers awards to students from the following scholarships based solely on academic excellence:

*William G. Anlyan, M.D. Scholarship*, established 1988 by gifts from faculty, staff and friends.

*Barham Endowed Merit Fund*, established November, 1984, by gift from Mr. and Mrs. Joseph Barham, Oak Ridge, Louisiana.

*Family Dollar Scholarship*, established November, 1984, by gift from Mr. Leon Levine, Chairman of the Board, Family Dollar Stores, Inc., Charlotte, North Carolina; for minority students.

*Dr. William Redin Kirk Memorial Trust for North Carolinians*, established March, 1984, by bequest of Mr. Frederick H. Pierce, Owensboro, Kentucky.

*Mary W. and Foster G. McGaw Scholarship*, established February, 1986 by bequest from Foster G. McGaw.

*Dr. Kenneth L. Pickrell Scholarship*, established February, 1984, by gift from the Department of Surgery, Duke University Medical Center, for an entering student.

*School of Medicine Merit Fund*, established 1984 by gifts from medical alumni, students, and American Medical Association-Education and Research Foundation.

Senior Scholarships from the above funds (except Pickrell) are offered to third year students for use during their fourth year of study. Selection by a special committee is based on outstanding academic achievement during the first two years of medical school and extracurricular activities during those first two years. These scholarships, to be paid toward tuition, are in the range of \$5,000 each for ten awards, and are not in addition to any other tuition award.

Financial need is not a criteria for selection; however, applicants who feel their financial need is greater than the merit award may apply for financial aid.

**The Dean's Tuition Scholarships.** Seven Dean's Tuition Scholarships in the amount of current tuition are given to academically excellent freshmen minority students each year. Preference is given to residents of North Carolina. Selection is made by the dean based on recommendations from the Medical School Admissions Office. Annual renewal is contingent upon satisfactory academic progress.

## Medical Student Research Scholarships

Several groups now sponsor medical student research scholarships. In most of the scholarship programs, students selected for scholarships are eligible to receive thirty-two basic science credits for the experience.

Some have delegated the responsibility to the Medical School to select participants in the program, others have their own independent selection processes. A full twelve months is required for the research experience. Selection for the following awards is made by the Student Research Scholarship Committee.

*Gorrell Award for Research in Psychosis.* The Gorrell Research Award provides for studies on mechanisms underlying psychosis, particularly schizophrenia and bipolar illnesses. Emphasis is on research of the processes that elucidate the behavioral neurobiology of psychosis. For an application, please contact Dr. Galen Wagner, Erwin Square, Bay C, Room 202. For any questions regarding the award, please call Dr. Everett Ellinwood or Sarah Dusseault at 684-3329. Two stipends are available at \$10,000 each. The deadline for submission is the same as for the Stead Scholarships. The student's



preceptor must have a primary appointment either in psychiatry or in a basic science department.

*Eugene A. Stead Student Research Scholarship Program.* This program is sponsored by the Duke Department of Medicine in honor of Eugene A. Stead, Jr., M.D., chairman of the Department of Medicine from 1947 until 1967. Three to four students are selected each year as Stead Scholars. Two of the Stead Scholarships are supported by endowments from individual patients of Dr. James Clapp: Jay D. and Lorraine Nicewonder and the Loo Cheng Ghee family. The third scholarship is supported by an endowment by those at Duke and elsewhere who were trained in internal medicine by Dr. Stead. The Robert T. and Virginia McDaniel-Stead Scholarship is an endowed scholarship intended to support basic cardiovascular research. The McDaniels are patients of Dr. Andrew Wallace.

*Stanley J. Sarnoff Society of Fellows for Research in Cardiovascular Sciences.* Ten students are chosen nationally for a full twelve-month research experience in the cardiovascular area, away from their parent medical school. Duke has typically had one position in this program. The program is in its thirteenth year and there is a great deal of esprit de corps within the "Sarnoff Society of Cardiovascular Fellows." There is an annual meeting in Bethesda, Maryland, in which the ten fellows engaged in research during that year present their work, fellows who have completed their research year talk about their developing career plans, and newly selected fellows learn about possible research opportunities.

*The American Heart Association Medical Student Research Fellowship Program.* Duke is one of twenty-five schools selected by the American Heart Association for one of their Student Research Scholarship Programs. Two positions each year are available. These scholarships differ from all others in that the funding organization does not permit the student to receive academic credit while they are American Heart Scholars. Therefore, these scholarships have been used by students who had rewarding experiences during their basic science elective year in cardiovascular research and then chose to add a second dedicated research year before completing their clinical elective year as a Duke medical student.

All students applying to these programs prepare their applications and receive interviews during the second year of medical school. Announcements of the scholarship recipients are made in April.

In addition, there are other foundations which support student research scholarship programs and are approved for Duke University School of Medicine credit but have their own methods for evaluation and selection. Because of the unique nature of the Duke University School of Medicine curriculum, we have been highly successful in having students in the various programs. The Howard Hughes/National Institutes of Health Research Scholars Program requires that the student works in a particular institution away from their parent medical school. The Hughes/NIH program selects thirty students each year to live on the NIH campus and work in one of their basic science laboratories. During 1993-94 four of these positions were occupied by Duke students. We have also been very successful in having our students in scholarship programs supported by the Howard Hughes Medical Institute, the Few Foundation, Arthritis Foundation, the Pharmaceutical Manufacturers Foundation, and the Fight for Sight Foundation.

## Financial Aid

The Duke University School of Medicine makes financial assistance available to accepted students who, due to economic circumstances, could not otherwise attend the university. The school recognizes, however, the responsibility of the individual and the family to provide funds to achieve the objective of a medical education. Thus, the school does not consider that parents have discharged the full financial obligation for the

continuing education of their sons or daughters upon the latter's completion of the undergraduate degree.

Financial assistance is available in a combined form of grants and loans, and all awards are made on the basis of demonstrated need to U. S. citizens who are otherwise eligible.

**Financial Assistance to Incoming Freshmen.** A financial aid application packet is routinely mailed in February to applicants who have been accepted. This mailing is without regard to whether the applicant expressed an interest in assistance on the application for admission. The economic circumstance of the applicant has no bearing on whether the applicant is accepted into the medical school.

The applicant requesting financial aid is expected to work during the summer preceding entrance into medical school and to save part of those earnings to defray a portion of the first-year expenses.

The applicant's need is determined before an award is made. The Office of Financial Aid, therefore, requires the Duke University Medical Center application for financial aid, and computations from the Financial Aid Form (FAF), in addition to the Free Application for Federal Student Aid (FAFSA). Copies of federal income tax returns with supplemental schedules and a financial aid transcript from each school previously attended are also required as part of the financial aid application.

An official aid award notice is sent to the accepted applicant within a few days after receipt of the required forms. Awards are conditional until all required documents are received.

The present financial aid package, which is subject to change, for qualified North Carolinians (those who meet state residency law prior to matriculation) is based on a tuition grant up to \$11,750. Financial need in excess of \$11,750 must come next from a \$5,000 Stafford student loan (formerly GSL), and need in excess of \$5,000 comes from one-half school grant and one-half Stafford student loan up to \$3,500, then Duke loan.

The present financial aid package, which is subject to change, for qualified students in years 2, 3 and 4 from outside North Carolina is based on a \$5,000 Stafford student loan. Financial need between \$5,000 and \$25,000 comes from one-half school grant and one-half from Stafford student loan up to \$3,500, then Duke loan.

Beginning with 1995-96, the package, which is subject to change, for first year out of state students need will be met as follows: the first \$5,000 will be met with the Stafford student loan; need between \$5,000 and \$25,000 will be met with one half school grant and one half from Stafford student loan up to \$3,500, then Duke loan. Need over \$25,000 will be funded with three fourths school grant and one fourth school loan.

**Financial Assistance to Upperclassmen.** Annual reapplication is required of all need based aid recipients. Upperclassmen seeking financial assistance for the first time may consult with the Administrator of Financial Aid.

**Duke University Medical Center Endowed Funds.**

*Barney Baker and Minnie P. Baker Endowed Scholarship Fund*, established March, 1992, by bequest of their son Barry Baker.

*Charles W. Banner Loan Fund*, established in 1953 by a gift from Mrs. Edward B. Benjamin.

*Germain Bernard Scholarship*, established in 1959 by the B. C. Remedy Company.

*Thomas C. Bost Scholarship*, established in 1965 by a gift from Dr. Thomas C. Bost, supplemented by subsequent gifts.

*Franklin and Louise Brown Medical Scholarship*, established March, 1992, by bequest of Franklin and Louise Brown.

*Elizabeth Burgess Bressler Memorial Scholarship Fund*, established in 1983 by her children: Garrett S. Bressler, M.D.; Robert B. Bressler, M.D.; Barbara B. Marques; Peter B. Bressler, M.D.

*Ortrude S. Busse Medical Scholarship Endowment*, established in 1993 by gift from her husband, Ewald W. Busse, M.D.

*James L. Clark Memorial Scholarship*, established in 1965 by a gift from Mr. and Mrs. Marvin D. Clark and supplemented by gifts from other donors.

*C. T. Council Scholarship*, established in 1959 by the B. C. Remedy Company.

*Helen M. Curtis Endowed Scholarship Fund*, established June, 1992, from the estate of Helen M. Curtis.

*John H. Dorminy Scholarship*, established in 1980 by gift from John H. Dorminy, Jr.

*Isobel Craven Drill Endowment for Medical School Scholarships*, established 1993 by Isobel Craven Drill.

*Herbert T. Dukes, M.D. Memorial Loan Fund*, established in 1983 by his classmates and friends.

*Eagles-Andrews Memorial Scholarship*, established in 1982 by a gift from Dr. and Mrs. William M. Eagles.

*William F. Franck Memorial Scholarship*, established in 1958 by gift from William F. Franck, Jr. '39, and supplemented by additional gifts.

*Constance I. Gottwald Medical Scholarship*, established 1987 with preference for minority students by gift from Constance I. Gottwald.

*Hazel Endowment Fund*, established 1984 by gift from Mr. and Mrs. William A. Hazel.

*Warren W. Hobbie Fund*, established in 1980 by trustees of the Warren W. Hobbie Charitable Trust.

*Earl P. Holt, Jr. Memorial Scholarship*, established 1986 by gift from family and friends for first or second year medical students with preference given to minority students.

*George Lee Hundley and Rebecca Barnhill Hundley Fund*, established in 1980 by gift from George Lee and Rebecca Barnhill Hundley.

*H. B. and Adelaide F. Ingle Medical Scholarship*, established in 1976 by gift from Mr. and Mrs. Harry B. Ingle.

*B. Everett Jordan Scholarship*, established in 1974 by the late Senator B. Everett Jordan and his widow, Katherine Jordan.

*Thomas D. Kinney, M.D. Memorial Scholarship*, established in 1980 by gifts from his widow, Dr. Eleanor R. Kinney, and their children: Thomas R. Kinney, M.D.; Eleanor D. Kinney, J.D.; Hannah C. Kinney, M.D.; and Janet S. Kinney, M.D.

*Dr. John Haden Lane Memorial Scholarship*, established in 1968 by gift from Edward H. Lane Foundation.

*E. C. Langston Medical Scholarship*, established in 1979 by bequest of Mrs. Denzil L. Mosteller.

*Paul E. Leviton Medical Scholarship*, established in 1981 from the estate of Paul E. Leviton.

*James Cecil McGehee Memorial Medical Scholarship*, established in 1975 by gift from C. G. McGehee, Jr.

*Medical Alumni Scholarship*, established in 1974 by Duke Medical Alumni.

*Medical Class of 1950 Fund*, established in 1980 by gifts from graduates of 1950.

*Medical Class of 1981 and AESCULAPIAN/80 Staff*, established in 1980.

*Medical School Faculty Wives Scholarship*, established in 1968 by a gift from the Medical School faculty wives whose source of funds is proceeds from the Nearly New Shoppe.

*John F. Ott Endowment Fund*, established in 1984 by bequest of John F. Ott, M.D., 1943.

*Henry A. Page Scholarship Fund*, established 1942 by gift from Henry A. Page, Jr., and Gertrude Wetherill Page.

*Physical Medicine Scholarship*, established in 1963 by gift from Central Carolina Convalescent Hospital, Inc., Greensboro, North Carolina.

*Queen Effat Muhammed Al Thenayan Medical Scholarship Endowment*, established 1993 by gift from Her Royal Highness Queen Effat Muhammed Al Thenayan.

*Radiological Science Medical Student Loan Fund*, established in 1980 by the Department of Radiology.





*Senior Class Gift*, established by graduates of classes of 1977 and 1978.

*Melvin D. and Judith N. Small Medical School Scholarship Fund* was established in 1976 by gift from Dr. Melvin D. and Mrs. Judith N. Small.

*Sigmund Sternberger Endowment Fund*, established in 1978 by gift from the Sigmund Sternberger Foundation, Inc., Greensboro, North Carolina.

*William E. Stevens, Jr. Scholarship*, established in 1983 by the Broyhill Foundation, Lenoir, North Carolina.

*B. W. Stiles Scholarship*, established in 1981 by gift from the Mary Duke Biddle Foundation.

*Francis and Elizabeth Swett Scholarship*, established in 1966 by gift from the late Dr. and Mrs. Swett.

*A. J. Tannenbaum Medical Scholarship*, established in 1990 by the Sigmund Sternberger Foundation, Greensboro, North Carolina.

*Larry and Violet H. Turner Scholarship*, established 1977 by gift from Drs. Larry and Violet H. Turner.

*Dr. Hillory M. Wilder Memorial Scholarship*, established in 1962 by bequest from Celeste Wilder Blake and Kenneth M. Blake.

*Sue Eggleston Woodward Memorial Scholarship*, established in 1966 by gifts from parents, relatives, and friends.

*Vivian Zirkle Memorial Scholarship*, established in 1981 by gift from Drs. Lewis and Sara Zirkle.

**Other Medical School Scholarships.** Mary Duke Biddle Foundation Scholarships, Duke University School of Medicine Scholarships, State of North Carolina (tuition remission up to \$2,000), and the Lettie Pate Whitehead Foundation.

**Federal Scholarships.** Armed Forces (Army, Navy, and Air Force) Scholarship programs may be available for accepted or enrolled students. The recipient receives full tuition, fees, and a monthly stipend in return for a commitment of service as a physician for each year of funding. The special application is made directly to the program in which the student is interested.

**Scholarships for Students of Exceptional Financial Need (EFN).** This federally funded program provides grant assistance to schools for students who qualify on the basis of federal criteria. Recipients, who are selected by the school, must be those who meet federal criteria for the grants. The selected student receives tuition and all other reasonable educational expenses (minus living expenses). Recipients must enter and complete a residency training program in a primary health care specialty not later than four years after completing the undergraduate medical education program; and, practice in the primary health care specialty for five years after completing the residency program. Students who fail to maintain an acceptable level of academic standing and graduates who fail to comply with the primary care requirements will be liable to the federal government for the amount of the EFN award and for interest on such amount at the maximum legal prevailing rate not later than three years after the date on which the individual breaches the agreement.

**Financial Aid for Disadvantaged Health Professions Students (FADHPS).** Recipients for this federally funded grant program are selected by the school on the basis of federal criteria. The selected student must be from a disadvantaged environment or from a low income family as described by federal regulations. Recipients of FADHPS scholarships must agree to meet the same primary health care service requirements as required of EFN scholarship recipients described above.

**Scholarships for Disadvantaged Students (SDS) and Loans for Disadvantaged Students (LDS).** Duke University School of Medicine does not participate in these two programs.

**Primary Care Loan (PCL).** was formerly known as *U. S. Health Professions Student Loan (HPSL)*. Recipients must agree to enter and complete a residency training program in primary health care not later than four years after the date on which the student graduates from the school; and, must practice in such care through the date on which the loan is repaid in full. Students who received their first HPSL funds before July 1, 1993, are exempt from this requirement.

If the borrower fails to complete a primary health care residency and to practice in a primary health care field, the loan balance will be recomputed from the date of issuance at an interest rate of 12 percent per year, compounded annually, instead of five percent.

**Health Education Assistance Loans (HEAL).** These federally guaranteed need-based loans are available to accepted or enrolled students. There is an annual maximum, and the interest is not subsidized during enrollment. The special application and more information is available in the Financial Aid Office. Although HEAL is a need-based loan, it is not part of our financial aid package for financially needy students.

**North Carolina Board of Governors Medical Scholarships.** Board of Governors Medical Scholarships (BGMS) are awarded annually to twenty first-year medical school candidates who have been accepted for admission at one of the four medical schools in North Carolina. BGMS recipients are selected from among candidates of all races who are financially disadvantaged state residents and who have expressed an interest in practicing medicine in the State of North Carolina. The awards provide a yearly stipend of \$5,000 plus tuition and all mandatory fees—except the Sickness and Accident Insurance, which may be covered if funds are available. The BGMS may be renewed for four years. Information about the scholarship may be obtained from the Financial Aid Office.

## Loans

University loans are available under the specific restrictions of the loan funds and are awarded on the basis of financial need. Some of them are: W. K. Kellogg Foundation Loan Fund, Seaborn L. Hardman Loan Fund, Medical Freshman Tuition Loan, Scott Loan Fund, Charles W. Banner Loan Fund, Carl Perkins Student Loans, Radiological Science Medical Student Loan Fund, and U. S. Health Professions Student Loans.

The Francis and Elizabeth Swett Loan Fund is an emergency loan available in small amounts to any medical student on a no-interest basis for a short period of time.

## Loans from Outside the University

**North Carolina Student Loan Program for Health, Science, and Mathematics.** These loans provide financial assistance to North Carolina residents who demonstrate need as determined by the board. Loans are available for study in the medical fields, mathematics, and science programs that lead to a degree. The applicant must be a domiciliary of North Carolina and accepted as a full-time student in an accredited associate, baccalaureate, master's, or doctoral program leading to a degree. Loan recipients in some professional or allied health programs may cancel their loans through approved service in shortage areas, public institutions, or private practice. Medical students may receive up to \$7,500 per year for each of the four years; master's degree students are eligible for two loans of up to \$5,000 each; bachelor's degree students are eligible for three loans of up to \$4,000 each. For application forms and more information write: Executive Secretary, North Carolina Student Loan Program for Health, Science, and Mathematics, P. O. Box 20549, Raleigh, North Carolina 27605, or telephone 919/733-2164.

**Federal Stafford Student Loans (formerly GSL).** The need-based Federal Stafford Student Loan is available to eligible students through many home-town banks and/or state agencies. For purposes of SSL and other Title IV funds, graduate and professional student are financially independent of parents. The annual maximum for medical students is \$8,500 with an aggregate maximum of \$65,500. The interest is federally subsidized until repayment begins six months after graduation.

There is a two year deferment of repayment for residency training for those who first borrowed prior to July 1, 1993. First-time borrowers *after* July 1, 1993, are not eligible for the two-year deferment of repayment for residency training.

Effective July 1, 1994, the loan origination fee is 3 percent, paid by the borrower on the amount of the loan—the fee is deducted from loan disbursements. Also effective at the same time is a 1 percent insurance fee deducted from the loan disbursements.

When repayment begins, the interest for those who first borrowed prior to October 1, 1992 is 8 percent during the first four years and 10 percent beginning with year five of the repayment period. For first time borrowers after October 1, 1992, the interest rate is annual variable based on a 91-day Treasury Bill plus 3.10 percent capped at 9 percent. Those who first borrow after July 1, 1994 will have an interest cap of 8.25 percent.

Federal Stafford Student Loans are available to eligible students who are unable to document financial need. In such cases, the student—not the federal government—is responsible for payment of the interest during enrollment and deferment periods.

In addition to the \$8,500 SSL (subsidized or unsubsidized), after July 1, 1994, students may be eligible for up to \$10,000 per academic year from the unsubsidized SSL. The aggregate maximum is \$73,000. The interest is not subsidized and it is based on 52-week Treasury Bill plus 3.10 percent capped at 11 percent. There is an origination fee of 3 percent and an insurance fee up to 1 percent—both may be deducted from the loan disbursements.

Additional information, including a financial aid brochure and approved student budgets, may be obtained by writing to Mrs. Nell Andrews, Director, Financial Aid, Box 3067, Duke University Medical Center, Durham, North Carolina 27710.



*Courses of Instruction*



# Anesthesiology

Professor: Joseph G. Reves, M.D. (Med. Univ. of South Carolina, 1969; M.S. (Alabama at Birmingham, 1973), *Chairman*.

Professors: Peter B. Bennett, Ph.D., D.Sc. (Southampton, England, 1964); William J. Murray, Ph.D. (Wisconsin, 1955), M.D. (North Carolina at Chapel Hill, 1962); Lloyd F. Redick, M.D. (Ohio State, 1958); Mark C. Rogers, M.D. (Upstate Medical Center, State University of New York, 1969); Bruno J. Urban, M.D. (Albertus Magnus, Germany, 1960); David S. Warner, M.D. (Wisconsin, 1980); Stanley W. Weitzner, M.D. (New York Univ., 1953).

Clinical Professor: John B. Leslie, M.D., (Duke, 1976).

Associate Professors: Cecil O. Borel, M.D. (Hahnemann, 1977); Fiona Clements, M.D. (Duke, 1975); Peter Glass, M.B., B.Ch. (Univ. of Witwatersrand, Johannesburg, South Africa, 1976); William J. Greeley, M.D. (Texas at Houston, 1976); Peter C. Huttemeier, M.D., Ph.D. (Univ. of Copenhagen, Denmark, 1977, 1989); Frank H. Kern, M.D. (Pennsylvania, 1987); Bruce Leone, M.D. (Florida, 1982); Jonathan B. Mark, M.D. (Stanford, 1978); Jon N. Meliones, M.D. (Tufts, 1984); Richard E. Moon, M.D., C. M. (McGill, 1973), M.Sc. (Univ. of Toronto, 1979); Robert Lawrence Reed, M.D. (Virginia, 1976); Debra A. Schwinn, M.D. (Stanford, 1983); Sidney A. Simon, Ph.D. (Northwestern, 1973); Robert N. Sladen, M.B., Ch.B. (Univ. of Cape Town, South Africa, 1970), M.R.C.P. (Royal Postgrad. Med. Sch., 1973).

Associate Clinical Professors: Norbertus P. de Bruijn, M.D. (Univ. of Groningen, The Netherlands, 1976); Elisabeth J. Fox, M.B., B.S. (London Univ., 1955); Kerri M. Robertson, M.D., F.R.C.P.(C) (Univ. of British Columbia), Dianne L. Scott, M.D. (North Carolina at Chapel Hill, 1978); Kerri M. Robertson, M.D., F.R.C.P.(C) (Univ. of British Columbia, 1980).

Assistant Professors: Andrew T. Canada, Pharm.D. (Philadelphia Coll. of Pharmacy and Science, 1968), Ph.D. (Massachusetts, 1985); Guy de Lisle Dear, M.B., Ch.B. (St. George's Hospital, London, England, 1979); Ronald D. Edgar, M.D. (Univ. of Manitoba, Canada, 1981); T. J. Gan, M.B., B.S., D.A., F.C.Anaes. (London Hospital Med. Coll., 1986); Brian Ginsberg, M.B., B.Ch. (Univ. of Witwatersrand, South Africa, 1975); Joel S. Goldberg, M.D. (Duke, 1977); Roy A. Greengrass, M.D. F.R.C.P.(C) (Univ. of Manitoba, 1973); Katherine P. Grichnik, M.D. (Tufts, 1987); H. David Hardman, M.D. (Minnesota, 1981); Caryn M. Hertz, M.D. (Rochester, 1986); Andrew K. Hilton, M.B., B.S., (Univ. of New South Wales, Australia, 1983); Lewis R. Hodgins, M.D. (New York, Downstate, 1985); James R. Jacobs, Ph.D. (Alabama at Birmingham, 1987); Rajiv Jhaveri, M.B. (Gujarat Univ., India, 1977); Madan M. Kwatra, Ph.D. (Univ. of Montreal, 1977); Catherine K. Lineberger, M.D. (North Carolina at Chapel Hill, 1987); David Lubarsky, M.D. (Washington Univ., 1984); Judith Margolis, M.D. (Colorado, 1984); Mark F. Newman, M.D. (Louisville, 1985); Stephen Parrillo, M.D. (Univ. of Bologna, Italy, 1982); Claude Piantadosi, M.D. (Johns Hopkins, 1975); Scott R. Schulman, M.D. (George Washington, 1982); Karen S. Sibert, M.D. (Baylor, 1983); Thomas F. Slaughter, M.D. (Duke, 1987); Lloyd R. Smith, Ph.D. (Alabama at Birmingham, 1985); Susan Steele, M.D. (Illinois, 1983); Timothy H. J. Webb, M.D. (Texas at San Antonio, 1980), Ph.D. (Texas at San Antonio, 1974); Christopher C. Young, M.D. (New York Med. Coll., 1987).

Assistant Clinical Professors: Robert L. Coleman, M.D. (Virginia, 1984); Jennifer T. Fortney, M.D. (Maryland, 1978); Andrew F. Meyer, M.D. (New York, Downstate, 1969); Ziaur Rahman, M.B., B.S., (Prince of Wales Medical Center, India, 1968); Katherine King, M.D. (North Carolina at Chapel Hill, 1988).

Visiting Assistant Professor: Michael C. Hauser, (Southern California, 1989); David W. Amory, M.D., (Univ. of British Columbia, 1967).

Assistant Research Professors: Barry W. Allen, Ph.D. (Duke, 1984); Wayne A. Gerth, Ph.D. (California at San Diego, 1979); Ying-Fu Su, Ph.D. (Colorado, 1978); Richard Vann, Ph.D. (Duke, 1976); Yu-Ting Xuan, M.D. (Shan-xi Med. Coll., China, 1977), Ph.D. (Duke, 1990).

Associates: Elizabeth A. Bell, M.D. (North Carolina, 1990); Francine D'Ercole, M.D. (Med. Coll. of Pennsylvania, 1989); Mark E. Dentz, M.D. (Michigan, 1989); Veeraindar Goli, M.B., B.S. (Osmania Med. Coll., Hyderabad, India, 1978); Amy Beth Hilton, M.D. (Brown, 1988); Richard E. Johnson, M.D. (Brown, 1988); Allison Lee Ross, M.D. (Marshall, 1988); Iain Sanderson, M.A., M.Sc., F.R.C.A. Anaes. (Oxford Univ., England, 1985); Bret Stolp, M.D. (North Carolina at Chapel Hill, 1988), Ph.D. (Duke, 1985); Dana N. Weiner, M.D. (Duke, 1989).

Visiting Associate: Michael G. Mythen, F.R.C.A. (Middlesex Hospital Med. School, 1984).

Adjunct Professor: Kwen Jen Chang, Ph.D. (New York at Buffalo, 1972).

Adjunct Assistant Professor: Fritz F. Klein, Ph.D. (Duke, 1973).

Assistant Consulting Professors: John J. Freiburger, M.D. (Southwestern, 1979); Edward Burt McKenzie, Jr., M.D. (North Carolina at Chapel Hill, 1985); Gary Lee Pellom, M.D. (North Carolina at Chapel Hill, 1984); Thomas E. Stanley III, M.D. (Duke, 1981); Rolf B. Wallin, M.D. (North Carolina at Chapel Hill, 1984).

Research Associates: Pierre Albaladejo, M.D. (Univ. of Pierre et Mari Curie, 1994); Barbara Breinbauer, M.D., (Univ. of Munich, 1989); Baowei Chen, Ph.D., (Georgia, 1994); Keesoo Lee,

Ph.D. (Georgia, 1994); Lingyuan Li, Ph.D., (Peking Union Med. Coll., 1953); Yan Lie Liu, M.D., (Nanjing Railway Med. Coll., 1983); Yoshiko Morimoto, M.D., (Hokkaido Univ., 1991); Yuji Morimoto, M.D., Ph.D., (Hokkaido Univ., 1986 and 1993); Peter Potgieter, MB, Ch.B., FFA (SA) (Univ. of Cape Town, 1967, South African Coll. of Med., 1972); Charlene D. Richardson, Ph.D., (Texas A&M, 1994); Seiji Takaoka, M.D., (Yamagata Univ., 1988); (Jenny) Shao-jie Wang, Ph.D. (Arizona State, 1993); Kuo-Yang Wang, M.D. (Taipei Med. Coll., 1986); William White, M.P.H., (North Carolina at Chapel Hill, 1988).

Scholar in Residence: Kenneth Sugioka, M.D. (Washington Univ., 1949).

Emeritus: Edmond C. Bloch, M.B., Ch.B. (Univ. of Cape Town, South Africa, 1946); Merel H. Harmel, M.D. (Johns Hopkins, 1943); Joannes H. Karis, M.D. (State Univ. of Utrecht, Holland, 1952).

**ANE-215C. Advanced Cardiac Life Support (ACLS).** The ACLS Provider course follows the American Heart Association (AHA) guidelines. This course consists of four one-hour lectures, eight hours of skill stations and case-based teaching, and four hours of evaluation. The course is offered twice: May 22 to 26 and November 13 to 17, 1995. Instruction is scheduled over four days, in the afternoon. Prerequisite: Current Basic Life Support Certification (CPR). Weight: 1 Min: 10 Max: 50. *K. King*

**ANE-240C. Clinical Anesthesiology.** This course is designed to directly expose students to the clinical practice of anesthesiology. Throughout the rotation, each student is assigned on a weekly basis to an individual resident or attending physician who supervises the student's active participation in the pre-, intra-, and post-operative anesthetic care and management of patients. Opportunities exist for students to participate in the various subspecialty areas of anesthesiology including pediatric, obstetric, cardiac, and neurosurgical anesthesia as well as the recovery room, ICU, and pain clinic. While initial assignments are made prior to the first day of the rotation, there is flexibility with regard to students' particular areas of interest. The evaluation of patients pre-operatively is taught with emphasis placed upon formulating a plan of anesthetic management which is appropriate for the individual patient. The consequential impact of anesthetics and surgical procedures upon particular disease states is also stressed. Students review the clinical pharmacology of anesthetic and adjuvant drugs as well as apply the principles of pharmacology, physiology, and anatomy to the clinical anesthetic management of patients. Didactic information regarding principles of airway management including endotracheal intubation is presented and reinforced with application in the clinical setting. Participants are exposed to basic methods of administering anesthetics and monitoring the depth of anesthesia through physiologic responses of the patient. Instruction in the appropriate techniques and complications of obtaining vascular access for administering drugs and monitoring hemodynamic status is provided. In addition to this clinical work, students are given the opportunity to attend various lectures including an introductory series (covering preoperative assessment, airway management, and anesthesia equipment), grand rounds and resident lecture series, and various subspecialty conferences (cardiac, pediatrics). No drops or adds are accepted during the week before the course begins. Students wishing to drop or add two weeks prior to the start of the course must contact the director of medical student education, Kathryn King, M.D. (681-4390) Weight: 4 Max: 6. Not offered in July / August. *T. Webb and staff*

**ANE-241C. SICU/Recovery.** Four weeks may be spent in a Surgical Intensive Care Unit (SICU) participating in the care of a wide variety of patients with critical surgical illnesses. The students participate in morning and afternoon rounds with SICU attendings, fellows, and residents and are offered lectures on aspects of critical care several times per week. They also take call one night in four and have an excellent opportunity to work on a one-on-one basis with the SICU house staff in the direct management of critically ill patients. Two weeks are spent in the SICU at Duke University Medical Center (trauma, vascular surgery, liver-kidney-pancreas transplantation, general surgery) and two weeks in the SICU at the Durham VA Medical Center (cardiothoracic and vascular surgery, general surgery). There is emphasis on teaching of procedures and techniques necessary for the management of all critically ill patients (e.g. vascular catheterization,



hemodynamic monitoring and management, vasoactive drugs, and mechanical ventilation). Weight: 5 Max: 6. *Sladen and staff*

**ANE-242C. Anesthesiology Research.** Selected students participate actively in assigned research projects. These well-focused segments of ongoing work in the Department of Anesthesiology are designed to provide an intensive exposure to the process of new investigation in applied pharmacology and physiology. Most students are based in the Anesthesiology Research Laboratories and are strongly oriented toward personal involvement in the clinical research settings in the Duke Medical Center operating rooms, obstetrical delivery areas, post-operative and intensive care units, the Hyperbaric Laboratories, the pain clinic, or the Clinic Research Unit. An important goal of this experience consists of guiding the student to take conceptual information and to change it into concrete scientific presentation and publication. This course is designed primarily for the student who wishes to consider seriously a career in academic anesthesiology. Weight: 4-8 Max: 2. *P. Glass and staff*

## Biochemistry

George Barth Geller Professor Christian R. H. Raetz, M.D., Ph.D. (Harvard, 1973), *Chairman*.

Professors: James B. Duke Professor Robert M. Bell, Ph.D. (California at Berkeley, 1970); G. Vann Bennett, M.D., Ph.D. (Johns Hopkins, 1976); Perry J. Blackshear, M.D. (Harvard, 1977); James B. Duke Professor Irwin Fridovich, Ph.D. (Duke, 1955); Arno L. Greenleaf, Ph.D., (Harvard, 1974); Gordon G. Hammes, Ph.D. (Wisconsin, 1959); James B. Duke Professor Robert L. Hill, Ph.D. (Kansas, 1954); Tao-Shih Hsieh, Ph.D. (California at Berkeley, 1976); Norman Kirshner, Ph.D. (Pennsylvania State, 1952); Nicholas M. Kredich, M.D. (Michigan, 1962); James B. Duke Professor Robert J. Lefkowitz, M.D. (Columbia, 1966); James B. Duke Professor Paul L. Modrich, Ph.D. (Stanford, 1973); K. V. Rajagopalan, Ph.D. (Univ. of Madras, 1957); David C. Richardson, Ph.D. (Massachusetts Inst. of Tech., 1967); Jane S. Richardson, M.S., M.S.T. (Harvard, 1966); Lewis M. Siegel, Ph.D. (Johns Hopkins, 1965); Leonard D. Spicer, Ph.D. (Yale, 1968); Deborah A. Steege, Ph.D. (Yale, 1974); Robert E. Webster, Ph.D. (Duke, 1965).

Associate Professors: Michael D. Been, Ph.D. (Washington, 1982); Carol A. Fierke, Ph.D. (Brandeis, 1984); Ronald C. Greene, Ph.D. (California Inst. of Tech., 1954); Bernard Kaufman, Ph.D. (Indiana, 1961); Keith L. Parker, M.D., Ph.D. (Washington, 1981); Harvey J. Sage, Ph.D. (Yale, 1958); J. Bolling Sullivan, Ph.D. (Texas, 1966).

Assistant Professors: Lorena S. Beese, Ph.D. (Brandeis, 1984); Patrick Casey, Ph.D. (Brandeis, 1986); Stephen Garrett, Ph.D. (Johns Hopkins, 1986); Homme W. Hellinga, Ph.D. (Cambridge, 1986); Michael S. Hershfield, M.D. (Pennsylvania, 1967); Russel E. Kaufman, M.D. (Ohio State, 1973); Terrence Oas, Ph.D. (Oregon, 1986); Sheldon R. Pinnell, M.D. (Yale, 1963); Salvatore V. Pizzo, M.D., Ph.D. (Duke, 1973).

Assistant Research Professor: Jean L. Johnson, Ph.D. (Duke, 1974).

Adjunct Assistant Professor: Per-Otto Hagen, F.H.W.C. (Watt Univ., Scotland, 1961).

Research Associates: Neera Agrwal, Ph.D.; Dwayne Allen, Ph.D.; Pawan Bali, Ph.D.; Elaine Bardes, Ph.D.; Wendy Bedale, Ph.D.; Ludmil Benov, Ph.D.; Lawrence Bergman, Ph.D.; June Brickey, Ph.D.; Kathryn Brozek, Ph.D.; Scott Carpenter, Ph.D.; Tony Clementz, Ph.D.; Wing Chan, Ph.D.; Dawn Cahndrasekhar, Ph.D.; Eva M. Click, Ph.D.; Vivian Dao, Ph.D.; Margaret Daughtery, Ph.D.; Robert de Lorimer, Ph.D.; Gary Dotson, Ph.D.; Jim Drummond, Ph.D.; Allen E. Eckhardt, Ph.D.; Kim Gernert, Ph.D.; Sujoy Ghosh, Ph.D.; Alfred Hausladen, Ph.D.; Barbara Hindenach, Ph.D.; Guewha S. Huang, Ph.D.; Jennifer Hunt, Ph.D.; James Inglese, Ph.D.; Mahesh S. Joshi, Ph.D.; Thomas W. Kersby, Ph.D.; Thom LaBean, Ph.D.; Donnal Lee, Ph.D.; Jae Lee, Ph.D.; Guomin Li, Ph.D.; Stefan I. Liochev, Ph.D.; Matthew Longley, Ph.D.; Chris McMaster, Ph.D.; Marcos Milla, Ph.D.; David W. Myers, Ph.D.; Somashe Niranjana, Ph.D.; Juan Perez-Vilar, Ph.D.; Madaiah Puttaraju, Ph.D.; Andrew F. Quest, Ph.D.; Gong Shen, Ph.D.; Jian-Jun Shen, Ph.D.; Hope Taylor, Ph.D.; Julia Thissen, Ph.D.; Neil Tweedy, Ph.D.; Ronald A. Venters, Ph.D.; David Volk, Ph.D.; Hai Minh Vu, Ph.D.; Margot Wuebbens, Ph.D.; Kim White, Ph.D.; Leroy Worth, Jr., Ph.D.; Fen Zhang, Ph.D.; Lili Zhang, Ph.D.

Emeriti: Mary L. C. Bernheim, Ph.D.; Samson R. Gross, Ph.D.; Walter R. Guild, Ph.D.; Jerome S. Harris, M.D.; Kenneth S. McCarty, Sr., Ph.D.; Yashiko Nozaki, Ph.D.; Robert W. Wheat, Ph.D.

## Required Course

**BCH-200B. Biochemistry.** The core course given to all freshman medical students during a period of seven weeks in the first term emphasizes the relationship between structure and function of the major classes of macromolecules in living systems including proteins, carbohydrates, lipids, and nucleic acids. The metabolic interrelationships

and control mechanisms are discussed as well as the biochemical basis of human diseases. Weight: 4. *Rajagopalan*

## Electives

**BCH-215B. Molecular Genetics I: Genetic Mechanisms.** A comprehensive treatment of molecular and classical genetic mechanisms, emphasizing gene structure and function, genetic analysis gene in various experimental systems, as well as the behavior of chromosomes in replication, segregation, and recombination. C-L: Graduate School. Weight: 3. *Nevins and staff*

**BCH-321B. Hormone and Tissue Interactions in Differentiation and Disease.** Hormones and other biochemical signals involved in the regulation of the differentiated state including amino acids, polypeptide, and steroid hormone response in insects, snails, and higher vertebrates are discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of the chromatin. Cell-cell, cell-matrix, and hormonal interactions are considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix are discussed in terms of differentiation of limb bud/pancreas/lymphocyte/neural tissue. Conferences include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. The course is designed as an extension of the course Differentiation in Development and Disease. C-L: CBI 321B; PTH 321B; Graduate School. Weight: 2 Max: 5. *B. Kaufman and K. McCarty Sr.*

**BCH-357B. Research in Biochemistry.** In a limited number of cases, a student is permitted to participate in the research program of a faculty member. Acceptance is by individual arrangement with the proposed faculty preceptor. Weight: 1-16. *Staff*

**BCH-358B. Research in Biochemistry.** A student may obtain first hand research experience by participating in the research program of a faculty member. Acceptance is by individual arrangement with the proposed faculty preceptor. Weight: 1-16. *Staff*

**BCH-417B. Membranes, Receptors, and Cellular Signalling.** Basic and current concepts of the biological membranes, membrane proteins and organization; mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanism of regulation of hormone responsiveness, regulation of growth, differentiation and proliferation, cellular electrophysiological mechanisms of transport and ions channels, secretory and sensory stimulus sensing and transduction. Some lectures stress the clinical correlation of the basic concepts in the course. C-L: CBI 417B; Graduate School. Weight: 3. *Caron, Webster, Bell, and invited lecturers*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

BCH 259B. Molecular Biology I: Protein and Membrane Structure/Function

BCH 268B. Molecular Biology II: Nucleic Acids

BCH 291B. Physical Biochemistry

## Biological Anthropology and Anatomy

Professor: Richard F. Kay, Ph.D. (Yale, 1973), *Chairman*.

Professors: Matthew Cartmill, Ph.D. (Chicago, 1970); Kenneth Glander, Ph.D. (Chicago, 1975); William L. Hylander, D.D.S. (Illinois, 1963), Ph.D. (Chicago, 1972); James B. Duke Professor Elwyn L. Simons, Ph.D. (Princeton, 1956), D. Phil. (Oxford, 1959); John Terborgh, Ph.D. (Harvard, 1963).

Associate Professors: V. Louise Roth, Ph.D. (Yale, 1982); Kathleen K. Smith, Ph.D. (Harvard, 1980); Carel van Schaik, Ph.D. (Utrecht, 1985).

Assistant Professors: Frank H. Bassett III, M.D. (Louisville, 1957); Mary C. Maas, Ph.D. (New York at Stony Brook, 1988); Theresa R. Pope, Ph.D. (Florida, 1989); Frances J. White, Ph.D. (New York at Stony Brook, 1986).



Assistant Research Professors: Deborah Overdorff, Ph.D. (Duke, 1991); Diane M. Waddle, Ph.D. (New York at Stony Brook, 1993).

Adjunct Associate Professor: Patricia C. Wright, Ph.D. (City Univ. of New York, 1985).

Research Associates: Friderun Ankel-Simons, Ph.D. (Copenhagen, 1963); Marianne Bouvier, Ph.D. (Duke, 1982); Michael E. Pereira, Ph.D. (Chicago, 1984); Jacqueline A. Runestad, Ph.D. (Johns Hopkins, 1994); Peter S. Ungar, Ph.D. (New York at Stony Brook, 1992); Blythe A. Williams, Ph.D. (Colorado, 1994).

Instructor: Kirk Johnson, M.A. (Duke, 1981).

Emeritus: Kenneth L. Duke, Ph.D. (Duke, 1940).

## Required Course

**BAA-200B. Gross Human Anatomy.** First-year medical students are required to take gross anatomy. All instruction is designed to be informal and individualized. Weight: 4. *Hylander*

**BAA-200B. Gross Human Anatomy.** Includes complete dissection of a cadaver; laboratory work is supplemented by conferences which place emphasis upon biological and evolutionary aspects. Weight: 2. *Staff*

## Electives

**BAA-214B. Anatomy of the Head and Neck.** This course is designed to be a review of the head and neck, emphasizing its phylogenetic and ontogenetic development along with clinically important features of the anatomy of this region. Weight: 2 Min: 5 Max: 12. *K. Smith and staff*

**BAA-221B. Anatomy of the Trunk.** Emphasis is on the anatomy of the thoracic, abdominal, and pelvic organs including relationships, blood supply, and innervations and, where practical, developmental and microscopic anatomy. The dissections are supplemented with audiovisual presentations and discussions with such prosections as are available. Weight: 2 Min: 8 Max: 20. *Staff*

**BAA-224B. Tutorial in Gross Anatomy.** A detailed review of selected regions of the human body in the context of the "core" gross anatomy sequence. The student plans prosections, special presentations, etc., with staff. The student also elects to study one or more selected regions in consultation with staff. Weight: 1-5 Min: 1 Max: 5. *Hylander and staff*

**BAA-231B. Anatomy of Back and Extremities.** The course includes complete dissection of back and extremities including pectoral and pelvic girdles. Visual aids are used extensively. Course planned for orthopaedics, general practice, or neurosurgery. Weight: 3 Min: 6 Max: 20. *Bassett and staff*

## Cell Biology

George Barth Geller Professor for Research in Molecular Biology Michael P. Sheetz, Ph.D. (California Institute of Technology, 1972), *Chairman*.

Associate Professor Daniel P. Kiehart, Ph.D. (Pennsylvania, 1979), *Chief, Division of Developmental Biology*.

Professor Lazaro J. Mandel, Ph.D. (Pennsylvania, 1969); *Chief, Division of Physiology and Cellular Biophysics*.

Professors: G. Vann Bennett, M.D. (Johns Hopkins, 1976); James B. Duke Professor J. Joseph Blum, Ph.D. (Chicago, 1952); Celia Bonaventura, Ph.D. (Texas at Austin, 1968); Joseph Bonaventura, Ph.D. (Texas at Austin, 1968); Marc G. Caron, Ph.D. (Miami, 1973); Sheila J. Counce, Ph.D. (Edinburgh, 1954); Harold P. Erickson, Ph.D. (Johns Hopkins, 1969); John W. Gutknecht, Ph.D. (North Carolina at Chapel Hill, 1963); Diane L. Hatchell, Ph.D. (Marquette, 1968); Frans F. Jöbsis, Ph.D. (Michigan, 1958); James B. Duke Professor Edward A. Johnson, M.D. (Sheffield, 1953); Melvyn Lieberman, Ph.D. (State Univ. of New York, 1964); Thomas J. McIntosh, Ph.D. (Carnegie Mellon, 1973); Thomas J. McManus, M.D. (Boston, 1955); R. Bruce Nicklas, Ph.D. (Columbia, 1958); George M. Padilla, Ph.D. (California at Los Angeles, 1960); Robert Plonsey, Ph.D. (California, 1956); Michael K. Reedy, M.D. (Washington, 1962); George G. Somjen, M.D., (New Zealand, 1961); Joachim R. W. Sommer, M.D. (Munich, 1951); Madison S. Spach, M.D. (Duke, 1954).



Associate Professors: Onyekwere E. Akwari, M.D. (Southern California, 1970); Nels C. Anderson, Ph.D. (Purdue, 1964); Peter B. Bennett, Ph.D., D. Sc., (Southampton, England, 1964); Frederick R. Cobb, M.D. (Mississippi, 1964); Joseph M. Corless, M.D., Ph.D. (Duke, 1972); Joseph C. Greenfield, M.D. (Emory, 1956); Elliott Mills, Ph.D. (Columbia, 1964); Frederick H. Schachat, Ph.D. (Stanford, 1974); David W. Schomberg, Ph.D. (Purdue, 1965); Bryant W. Stolp, M.D. (North Carolina at Chapel Hill, 1988), Ph.D. (Duke, 1985); Steven R. Vigna, Ph.D. (Washington, 1978); Jo Rae Wright, Ph.D. (West Virginia, 1981).

Assistant Professors: Page A. W. Anderson, M.D. (Duke, 1963); Yair Argon, Ph.D. (Harvard, 1980); Bruce A. Benjamin, Ph.D. (Oklahoma, 1980); Blanche Capel, Ph.D. (Pennsylvania, 1989); Jonathan Cohn, M.D. (Rockefeller, 1978); Laura I. Davis, Ph.D. (Rockefeller, 1987); Arturo De Lozanne, Ph.D. (Stanford, 1988); William A. Dittman, Jr., M.D. (Washington, 1981); Marc K. Drezner, M.D. (Pittsburgh, 1970); Richard G. Fehon, Ph.D. (Washington, 1986); Michael S. Freemark, M.D. (Duke, 1976); William E. Garrett, Jr., M.D., Ph.D. (Duke, 1976); Yusuf A. Hannun, M.D. (American Univ. of Beirut, 1981); James D. Iglehart, M.D. (Harvard, 1975); L. Allen Kindman, M.D. (Mount Sinai, 1983); William E. Kraus, M.D. (Duke, 1982); Virginia Ann Lightner, M.D., Ph.D. (Duke, 1982); Haifan Lin, Ph.D. (Cornell, 1990); Allen W. Mangel, M.D. (Georgetown, 1988), Ph.D. (Illinois, 1980); Douglas A. Marchuck, Ph.D. (Chicago, 1985); Tobias Meyer, Ph.D. (Basel, 1986); Christopher V. Nicchitta, Ph.D. (Pennsylvania, 1987); Lina M. Obeid, M.D. (Beirut, 1983); Theresa O'Halloran, Ph.D. (North Carolina at Chapel Hill, 1986); Patricia M. Saling, Ph.D. (Pennsylvania, 1979); Robert N. Sladen, M.B., Ch.B. (Univ. of Cape Town, South Africa, 1970), M.R.C.P. (Royal Postgrad. Med. Sch., 1973); Jonathan S. Stamler, M.D. (Mt. Sinai, 1985); Katherine I. Swenson, Ph.D. (Washington, 1983); Margaret A. Titus, Ph.D. (Brandeis, 1987); Timothy J. Webb, M.D. (Texas at San Antonio, 1980), Ph.D. (Texas at San Antonio, 1974); William E. Yarger, M.D. (Baylor, 1971).

Associate Research Professors: Peter G. Aitken, Ph.D. (Connecticut, 1978); E. Ann LeFurgey, Ph.D. (North Carolina at Chapel Hill, 1976); Kenneth A. Taylor, Ph.D. (Berkeley, 1975).

Assistant Research Professors: Ling-Yi Chang, Ph.D. (North Carolina State, 1982); Bruce M. Klitzman, Ph.D. (Virginia, 1979); Michael K. Lamvik, Ph.D. (Chicago, 1976); Bruce Lobaugh, Ph.D. (Pennsylvania State, 1981); Luc Ménard, D.E.C. (CEGEP de l'Outaouais, Hull, Canada); E. Timothy O'Brien, Ph.D. (California at Santa Barbara, 1986).

Adjunct Professor: Martin Rodbell, Ph.D. (Washington, 1954).

Adjunct Associate Professors: Charles R. Horres, Jr., Ph.D. (Duke, 1975); J. Mailen Kootsey, Ph.D. (Brown, 1966); James M. Schooler, Jr., Ph.D. (Wisconsin, 1964).

Adjunct Assistant Professors: Reginald D. Carter, Ph.D. (Bowman Gray, 1970); Sarah K. Hall, Ph.D. (London, England, 1991); Leslie A. Lobaugh, Ph.D. (Duke, 1986); Elizabeth Murphy, Ph.D. (Pennsylvania, 1980); R. Neal Shepherd, Ph.D. (Duke, 1975).

Emeritus: R. J. Reynolds Professor in Medical Education Montrose J. Moses, Ph.D. (Columbia, 1949); Jacqueline A. Reynolds, Ph.D. (Washington, 1963); James B. Duke Professor Knut Schmidt-Nielsen, Dr.Phil. (Copenhagen, 1952).

## Required Courses

**CBI-200B. Cell Biology.** Lectures on the structure and function of the cells and tissues of the body. The laboratory provides practical experience with light microscopy studying and analyzing the extensive slide collection of mammalian tissues. Weight: 2. *McIntosh and staff*

**CBI-201B. Microanatomy.** Lectures on the structural organization of the organs of the body, as determined by light and electron microscopy, with emphasis on the relation of structure to function at the cellular level. Laboratory sessions are used to study histological preparations of mammalian tissues. Weight: 2. *McIntosh and staff*

**CBI-202B. Medical Physiology.** Lectures and conferences on cell and organ physiology. Human and medical aspects are stressed in clinical conferences. Lectures, conferences, and computer-based laboratory exercises. Weight: 4. *N. Anderson and staff*

## Electives

**CBI-211B. Cellular Mechanisms of Injury.** Selected topics in mechanisms of injury at the cellular and molecular levels chosen for reading and discussion in a combined lecture/seminar format. Subject matter varies each semester; can be taken more than once. Prerequisite: consent of instructor. C-L: Graduate School. Weight: 2 Min: 5 Max: 10. *LeFurgey, Mandel, and guest faculty*

**CBI-212B. The Cell and Molecular Biology of Reproduction.** During the last decade, cell, molecular, and neurobiological investigations have dramatically advanced our understanding of reproduction. In this course, we aim to focus on these recent

findings to present an integrated view of the reproductive process in males and females. The general areas to be covered include neuroendocrinology, reproductive endocrinology, gametogenesis, and fertilization, although recent studies in areas such as gene regulation; intercellular communication; hormones, growth factors and signalling; and early development and differentiation, are emphasized. C-L: Graduate School. Weight: 3 Min: 6 Max: 20. *Saling and staff*

**CBI-219B. Preceptorship in Cell Biology/Physiology.** Guided independent study of original literature and/or research experience in cell biology and/or physiology. Prerequisites: consent of instructor and departmental director of Medical Studies. Weight: 1-16. *Padilla*

**CBI-220B. Topics in Biological Regulation.** Current studies on regulatory mechanism of biological processes at the molecular, cellular, and organismal level of organization form the basis of this seminar course. Lectures, individual student presentations, and group discussions of independent study projects and/or current research literature are included. Major emphasis is on the mechanisms of structural and functional integration of biological activities of interest to the participants. Weight: 1 Min: 6 Max: 17. *Padilla, Vigna, and Benjamin*

**CBI-222B. Respiratory System in Health and Disease.** Primary emphasis is on the physiology of respiration. Topics covered include pulmonary mechanics, gas exchange, ventilation-perfusion relationships, central and peripheral regulation of ventilation and respiratory responses to exercise, altitude and hyperbaric environments. Weight: 2 Min: 4. *Jöbsis*

**CBI-237B. Analytical Imaging in Biomedical Research.** Weekly seminars to discuss concepts and techniques in high resolution analytical imaging of cells and subcellular organelles and to review application of these concepts to structural-functional correlations in cell physiology and pathophysiology. C-L: Graduate School. Weight: 3 Min: 5 Max: 10. *LeFurgey, Ingram, and Kopf*

**CBI-251B. Molecular Cell Biology.** Current research topics in cell biology presented in a lecture and discussion format based on recent research papers. Topics include: protein secretion and trafficking; mitochondria and organelles; the nucleus; cytoskeleton and cell motility; extracellular matrix and cell adhesion; growth factors and signalling; cell cycle. Weight: 1. *Erickson*

**CBI-269B. Advanced Cell Biology.** Structural and functional organization of cells and their components with emphasis on current research problems and prospects. C-L: MIC 269B; Graduate School. Weight: 3. *Nicklas and staff*

**CBI-340B. Tutorial in Cell Biology/Physiology.** Selected topics are chosen for intensive reading and discussion. Topics may be chosen relating to basic problems of cytology, growth and development, biophysics, endocrinological control, neuroanatomy, physiological differentiation, and evolutionary origins of functional microsystems. Prerequisites: permission of faculty preceptor. C-L: Graduate School. Weight: 1-3 Max: 8. *Staff*

**CBI-414B. The Human Embryo.** The first eight weeks of development are considered in detail including fertilization, implantation, formation and function of embryonic membranes and placenta, and establishment of major organ systems. Emphasis is placed on distinctive features of human embryogenesis and on causes, identification, and treatment of congenital defects. Weight: 2 Min: 5 Max: 12. *Counce*

**CBI-417B. Cellular Signalling.** Basic and current concepts of biological membranes, membrane proteins and organization; mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanisms of regulation of hormone responsiveness, regulation of



growth, differentiation and proliferation, cellular electrophysiological mechanisms of transport and ion channels, secretory and sensory stimulus sensing and transduction. Some lectures stress the clinical correlation of the basic concepts elaborated in the course. C-L: BCH 417B; Graduate School. Weight: 3 Max: 12. *Caron, Bell, and invited lecturers*

## **ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS**

CBI 217B. Membrane Transport

CBI 259B. Molecular Biology I: Protein and Membrane Structure/Function

CBI 320B. Cell Differentiation in Development and Disease

CBI 321B. Hormone And Tissue Interactions in Differentiation and Disease

## **Community and Family Medicine**

Clinical Professor: James L. Michener, M.D. (Harvard, 1978); *Chairman*.

Professor: Barbara K. Rimer, Dr. P.H. (Johns Hopkins, 1981).

Assistant Professor: Joellen Schildkraut, Ph.D. (Yale, 1987).

Associate: Irene Tessaro, Dr. P.H. (North Carolina at Chapel Hill, 1992).

## **DIVISION OF BIOMETRY**

Associate Professor: William E. Wilkinson, Ph.D. (North Carolina at Chapel Hill, 1968); *Chief*.

Professors: J. P. Gibbons Professor Daniel G. Blazer II, M.D. (Tennessee, 1969), Ph.D. (North Carolina at Chapel Hill, 1980); Thomas E. Frothingham, M.D. (Harvard, 1951); Stephen L. George, Ph.D. (Southern Methodist, 1969).

Associate Professors: Mark R. Conaway, Ph.D. (Minnesota, 1985), John R. Feussner, M.D. (Vermont, 1973); Frank E. Harrell, Jr., Ph.D. (North Carolina at Chapel Hill, 1979); Kerry L. Lee, Ph.D. (North Carolina at Chapel Hill, 1974).

Assistant Professors: David M. DeLong, Ph.D. (North Carolina at Chapel Hill, 1977); Elizabeth R. DeLong, Ph.D. (North Carolina at Chapel Hill, 1979); James E. Herndon II, Ph.D. (North Carolina at Chapel Hill, 1988); Bercedis L. Peterson, Ph.D. (North Carolina at Chapel Hill, 1986); Gina R. Petroni, Ph.D. (Michigan, 1990); Carl F. Pieper, Ph.D. (Columbia, 1990); Gary L. Rosner, Sc.D. (Harvard, 1985); Gregory P. Samsa, Ph.D. (North Carolina at Chapel Hill, 1988); Lloyd R. Smith, Ph.D. (Alabama at Birmingham, 1985).

Research Professor: Kenneth G. Manton, Ph.D. (Duke, 1974).

Assistant Research Professor: Lawrence H. Muhlbaier, Ph.D. (North Carolina at Chapel Hill, 1981).

## **DIVISION OF MEDICAL INFORMATICS**

Professor: William E. Hammond, Ph.D. (Duke, 1967); *Chief*.

Assistant Research Professor: Joseph W. Hales, Ph.D. (Utah, 1991).

Research Associates: James D. Collins, Ph.D. (Duke, 1982); Roland Gettliffe, Ph.D. (Duke, 1989).

## **FAMILY MEDICINE PROGRAM**

### **PREDOC/FACULTY DEVELOPMENT DIVISION**

Assistant Clinical Professor: Victoria K. Johnson, M.D. (UCLA, 1985); *Chief*.

Assistant Professor: Linda S. Lee, Ph.D. (North Carolina at Chapel Hill, 1991).

Associate: Robert G. Shreve, Ed.D. (Virginia, 1992).

Assistant Clinical Professor: Joyce A. Copeland, M.D. (North Carolina at Chapel Hill, 1975). S. William Friedman, M.D. (Tulane, 1972); Barbara L. Sheline, M.D. (North Carolina at Chapel Hill, 1984), M.P.H. (North Carolina at Chapel Hill, 1984).

Clinical Associate: Amrit Singh, M.D. (West Virginia, 1990).

## **STUDENT HEALTH DIVISION**

Associate Clinical Professor: William Christmas, M.D. (Boston Univ., 1965); *Chief*.

Assistant Clinical Professor: Howard Eisenson, M.D. (Duke, 1979).

Clinical Associate: Loretta Sutphin Stenzel, M.D., (Duke, 1986).

## **FAMILY MEDICINE - RESIDENCY DIVISION**

Kathryn A. Andolsek, M.D. (Northwestern, 1975); *Chief*.

Assistant Professor: Jonathon L. Sheline, M.D. (North Carolina at Chapel Hill, 1984), M.P.H. (Harvard, 1978); Robert H. Sprinkle, M.D. (Cincinnati Coll. of Med., 1975), Ph.D. (Princeton, 1990).

Assistant Clinical Professors: Clark R. Denniston, M.D. (Georgetown, 1983); Margaret Gradison, M.D. (Cincinnati, 1981); Mary Lee Lobach, M.D. (Vanderbilt, 1984); Elizabeth Nadler, M.D. (New York Univ., 1985).

Clinical Associates: Brian Benjamin, M.D. (Rochester, 1991); William Gunn, Ph.D. (Virginia Polytechnic, 1986); Janet E. Lehr, M.D. (Florida, 1982); Victor Lerch, M.D. (Boston Univ., 1985).



Clinical Instructor: Joseph W. Kertesz, Jr., M.A. (Michigan, 1973).

## **FAMILY PRACTICE DIVISION**

Kimberly S. Yamall, M.D. (Florida, 1985), *Chief*.

Professors: David M. Eddy, M.D. (Virginia, 1963), Ph.D. (Stanford, 1978); Clark C. Havighurst, J.D. (Northwestern, 1958); George R. Parkerson, Jr., M.D. (Duke, 1953), M.P.H. (North Carolina at Chapel Hill, 1977); Harmon L. Smith, Ph.D. (Duke, 1962).

Associate Professors: Barrie J. Hurwitz, M.B. (Witwatersrand Univ., 1968); Joseph Lipscomb, Jr., Ph.D. (North Carolina at Chapel Hill, 1975); Robert J. Sullivan, Jr., M.D. (Cornell, 1966), M.P.H. (North Carolina at Chapel Hill, 1973).

Assistant Professors: Toni M. Cutson, M.D. (Virginia, 1980); Ruby L. Wilson, Ed.D. (Duke, 1968).

Associate: Catherine M. Severns, R.N.P. (Yale, 1971).

Assistant Clinical Professors: Melvin Berlin, M.D. (Duke, 1953); Albert A. Meyer, M.D. (SUNY at Brooklyn, 1975); Richard K. Serra, M.D. (Michigan, 1977).

Clinical Associates: Mohan M. Chilukuri, M.D. (Kentucky, 1982); Lauracinnie D. Jenkins, M.D. (SUNY at Buffalo, 1982); David Lobach, M.D. (Duke, 1987), Ph.D. (Duke, 1986).

Research Associate: William T. Vaughan, R.Ph., R.P.A. (North Carolina at Chapel Hill, 1972).

## **DIVISION OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE**

Associate Clinical Professor: George W. Jackson, M.D. (Western Reserve, 1968). *Chief*.

Professor: David G. Warren, J.D. (Duke, 1964).

Associate Professor: John Dement, Ph.D. (North Carolina at Chapel Hill, School of Public Health, 1980).

Associate Clinical Professor: Jerry J. Tulis, Ph.D. (Catholic University of America, 1965).

Assistant Professors: Linda M. Frazier, M.D. (Mount Sinai, 1980) M.P.H. (North Carolina at Chapel Hill, 1992); Samuel D. Moon, M.D. (Virginia, 1975), M.P.H. (North Carolina at Chapel Hill, 1991).

Associate: Dennis Darcey, M.D. (North Carolina at Chapel Hill, 1986) M.S.P.H. (North Carolina at Chapel Hill, 1988).

Assistant Clinical Professors: Gary N. Greenberg, M.D. (Northwestern, 1978), M.P.H. (North Carolina at Chapel Hill, 1983); Ricky L. Langley, M.D. (Bowman Gray, 1983), M.P.H. (North Carolina at Chapel Hill, 1988); Craig R. Stenberg, Ph.D. (Denver, 1982); Woodhall Stopford, M.D. (Harvard, 1969) M.S.P.H. (North Carolina at Chapel Hill, 1980); Wayne R. Thomann, Dr.P.H. (North Carolina at Chapel Hill, 1983); Camille M. Warren, M.D. (North Carolina at Chapel Hill, 1980).

Clinical Associate: David P. Siebens, M.D. (Washington, 1983); Andrew S. Silberman, M.S.W. (North Carolina at Chapel Hill, 1982).

Research Associate: James M. Schmidt, B.H.S. (Duke, 1974).

## **DIVISION OF PHYSICIAN ASSISTANT EDUCATION**

Associate Clinical Professor: Reginald D. Carter, Ph.D. (Bowman Gray, 1970), *Chief*.

Assistant Clinical Professor: Joyce A. Copeland, M.D. (North Carolina at Chapel Hill, 1975), *Medical Director*.

Assistant Professor: Malcolm Henderson Rourke, Jr., M.D. (Pennsylvania, 1963).

Assistant Clinical Professor: Lovest T. Alexander, M.H.S. (Duke, 1991); Patricia A. Dieter, M.P.A. (Pennsylvania State, 1983); Phillip Price, M.H.S. (Duke, 1991); Jan Victoria Scott, M.H.S. (Duke, 1991).

Clinical Associates: Robert Giggey, PA-C (Maine Medical Center, 1991); Paul C. Hendrix, M.H.S. (Duke, 1991); Gloria Jordan (Duke, 1988); John C. Lord, PA-C (Duke, 1981).

## **DUKE DIET AND FITNESS CENTER**

Assistant Clinical Professor: Michael A. Hamilton, M.D. (Rochester, 1964), M.P.H. (North Carolina at Chapel Hill, 1969) *Chief*.

Assistant Clinical Professor: Susan Head, Ph.D. (Louisiana State, 1991); Ronette L. Kolotkin, Ph.D. (Minnesota, 1978).

## **ADJUNCT FACULTY**

Adjunct Professors: Barbara S. Hulka, M.D. (Columbia, 1959), M.P.H. (Columbia, 1961), Chapel Hill, NC.

Adjunct Associate Professors: James F. Gifford, Jr., Ph.D. (Duke 1969) Durham, NC; Richard J. Levine, M.D. (St. Louis, 1971), Research Triangle Park, NC.

Adjunct Assistant Professors: James D. Bernstein, M.H.A. (Michigan, 1968) Raleigh, NC; Brian A. Boehlecke, M.D. (SUNY at Buffalo, 1970), M.P.H. (North Carolina at Chapel Hill, 1981), Chapel Hill, NC; Clare J. Sanchez, M.D. (Colorado School of Med, 1975); Daniel A. Shugars, D.D.S. (Northwestern, 1975), Ph.D. (Northwestern, 1978); Bonnie Yankaskas, Ph.D. (North Carolina at Chapel Hill, 1982), M.P.H. (Yale, 1973).

## **COMMUNITY FACULTY**

Associate Professor: Walter E. Broadhead, M.D. (Duke, 1981), Ph.D. (North Carolina at Chapel Hill, 1987).

Associate Clinical Professor: Charles Ellenbogen, M.D. (Chicago-Pritzker, 1964), Fayetteville, NC.

Assistant Clinical Professors: Jessie A. Junker, M.D. (Med Col of Wisconsin, 1984), Fayetteville, NC; James M. Wetter, M.D. (SUNY at Buffalo, 1974), Fayetteville, NC.

Clinical Associate: Oliver N. Oyama, Ph.D. (Indiana, 1985), Fayetteville, NC., Lenard Salzberg, M.D. (Albany, 1988).

Consulting Professor: Barrie Cassileth, Ph.D. (Pennsylvania, 1978) Chapel Hill, NC; Donald M. Hayes, M.D. (Bowman Gray, 1954), Greensboro, NC; Roger O. McClellan, D.V.M. (Washington State, 1960).

Associate Consulting Professors: Joan Cornoni-Huntley, Ph.D. (North Carolina at Chapel Hill, 1970), Chapel Hill, NC; Sigrid J. Nelius, M.D. (Ludwig Maximilian, Germany, 1949), Durham, NC; Katharine M. Simon, Ph.D. (Iowa, 1979) St. Louis, MO; Samuel W. Warburton, Jr., M.D. (Pennsylvania, 1969).

Assistant Consulting Professors: Anne M. Akwari, M.D. (Howard University, 1976); Lawrence M. Alexander, M.D. (Duke, 1952), Sanford, NC; J. Powell Anderson, M.D. (Duke, 1949), Waynesboro, VA.; William G. Aycock, M.D. (Duke, 1954), Mebane, NC; Evan A. Ballard, M.D. (Duke, 1976), Jonesville, NC; Daniel H. Barco, M.D. (Duke, 1972), Durham, NC; James E. Barham, M.D. (Duke, 1974), Anderson, SC; William J. Blackley, M.D., (North Carolina at Chapel Hill, 1975), Elkin, NC; James S. Blair, Jr., M.D. (Maryland, 1947), Wallace, NC; Donald E. Bley, M.D. (Duke 1972), Fredericksburg, VA; Don W. Bradley, M.D. (Med. Coll. of Va., 1976), Durham, NC; Susan E. Brown, M.D. (Georgetown, 1976), Durham, NC; Jack R. Cahn, M.D., (Penn. State at Hershey, 1972), Sparta, NC; Jane T. Carswell, M.D. (Med. Coll. of Va., 1958), Lenoir, NC; Robert S. Cline, M.D., (North Carolina at Chapel Hill, 1957), Sanford, NC; Timothy D. Coughlin, M.D. (Cincinnati, 1972), Reno, NV; John W. Cromer, Jr., M.D. (Nebraska, 1972), M.S.P.H. (North Carolina at Chapel Hill, 1980), Wilmington, NC; Bruce A. Dalton, Jr., M.D. (North Carolina at Chapel Hill, 1969), Research Triangle Park, NC; Charles Davant III, M.D. (North Carolina at Chapel Hill, 1972), Blowing Rock, NC; John D. Davis, Jr., M.D. (North Carolina at Chapel Hill, 1978), Blowing Rock, NC; Clyde J. Dellinger, M.D. (Duke, 1961), Drexel, NC; Curtis J. Eshelman, M.D. (Michigan, 1971), Durham, NC; Lawrence L. Fleenor, Jr., M.D., (Virginia, 1966), Big Stone Gap, VA; Henry A. Fleishman, M.D. (Emory, 1974); John S. Gaskin, Jr., M.D. (Duke, 1959), Albemarle, NC; Raymond A. Gaskins, Jr., M.D. (North Carolina at Chapel Hill, 1975), Fayetteville, NC; Harry I. Geisberg, M.D. (Louisville, 1972), Anderson, SC; E. Albino Gomez-Uria, M.D. (Madrid School of Medicine, 1962), Asheville, NC; Wilson Griffin III, M.D. (Duke, 1977), Jonesville, NC; James K. Hartye, M.D. (Vanderbilt, 1977), North Wilkesboro, NC; Paul O. Howard, M.D. (Virginia, 1955), Sanford, NC; Peter Jacobi, M.D. (Western Reserve, 1979), Durham, NC; Lane E. Jennings, M.D. (Miami, 1975), Port Orange, FL; Pamela H. Jessup, M.D. (Bowman Gray, 1977), Sanford, NC; Eric M. Johnsen, M.D. (Wayne State, 1977), Albemarle, NC; Lyndon K. Jordan, M.D. (Duke, 1965), Smithfield, NC; Hervy B. Komegay, Sr., M.D. (Bowman Gray, 1957), Mount Olive, NC; Charles W. Lapp, M.D. (Albany Med. Coll, 1974), Raleigh, NC; Walter L. Larimore, M.D. (Louisiana, 1977) Byron City, NC; Richard V. Liles, Jr., M.D. (North Carolina at Chapel Hill, 1957), Albemarle, NC; Rodney L. Lowman, Ph.D. (Michigan State, 1979), Bel Aire, TX; Mary E. Lyon, M.D. (Bowman Gray, 1977), Sparta, NC; Kathryn Magruder-Habib, Ph.D. (North Carolina at Chapel Hill, 1987), Washington, DC; Robert H. McConville, Jr., M.D. (Indiana, 1972), Sanford, NC; G. Yancey Mebane, M.D. (Duke 1954), Mebane, NC; Lawrence Myers, Ph.D. (California-Berkeley, 1972), RTP, NC; Susan F. Nelson, M.D. (Texas Health Science Center at Houston Medical School, 1985); James A. Oppold, Ph.D. (Florida, 1969), Raleigh, NC; George R. Parkerson III, M.D. (Duke, 1984), M.P.H. (Harvard, 1985), Boston, MA; Melvin T. Pinn, Jr., M.D. (Virginia, 1976), Charlotte, NC; Calvin Reams III, M.D. (Miami 1975), Thomasville, NC; Jessica Sax-Schorr, M.D. (Tufts, 1977), Charlotte, NC; Charles P. Scheil, M.D. (Duke, 1958), Lenoir, NC; Evelyn D. Schmidt, M.D. (Duke 1951), M.P.H. (Columbia, 1962), Durham, NC; Harold D. Schutte, M.D. (Loma Linda, 1962), Asheville, NC; Philip G. Singer, M.D. (Duke, 1975), Hillsborough, NC; Hal M. Stuart, M.D. (Bowman Gray, 1956), Elkin, NC; Richard L. Taylor, M.D. (North Carolina at Chapel Hill, 1962), Oxford, NC; Robert G. Townsend, M.D. (Louisville, 1960) Raeford, NC; Beverly W. Tucker, M.D., (North Carolina at Chapel Hill, 1966), Henderson, NC; George R. Tucker Jr., M.D. (North Carolina at Chapel Hill, 1955) Henderson, NC; Christopher Unger, M.D. (Pennsylvania, 1969), Bethesda, MD; William B. Waddell, M.D. (Duke, 1962), Galax, VA; John W. Watson, M.D. (Med. Coll. of Va., 1953), Oxford, NC; Bret C. Williams, M.D. (Kansas, 1976) M.P.H. (North Carolina at Chapel Hill, 1988) Yanceyville, NC; Abner C. Withers, M.D. (North Carolina at Chapel Hill, 1962), Morganton, NC; Glenn A. Withrow, M.D. (North Carolina at Chapel Hill, 1985), Durham, NC; Robert K. Yowell, M.D. (Duke, 1961), Durham, NC.

Consulting Associates: John B. Anderson, Jr., M.D. (Cincinnati, 1980), Oxford, NC; Gary O. Bean, M.D. (Bowman Gray, 1976), Raleigh, NC; Clarence H. Beavers, M.D. (West Virginia, 1982), Eden, NC; William H. Billica, M.D. (North Carolina at Chapel Hill, 1985, Phoenix, AZ; Mark G. Blumenthal, M.D. (Rutgers, 1987), M.P.H. (California, 1983); Kevin Broyles, M.D. (Florida, 1986), Chapel Hill, NC; Daniel D. Crummett, M.D. (Wayne State, 1982), Hillsborough, NC; Terry G. Daniel, M.D. (West Virginia, 1988) Eden, NC; Mary Carol Digel, M.D. (Duke, 1987) Sparta, NC; Jean E. Early, Pharm. D. (Campbell, 1991) Fayetteville, NC; Ann K. Freneau, M.D. (George Washington, 1985) Durham, NC; Lawrence L. Golusinski, M.D. (Med. College of VA, 1989) Atlanta, GA; William E. Hall, M.D. (Abraham Lincoln Coll. of Med., 1973), Sanford, NC; Christopher D. Hoffman, M.D. (Med. Coll. of Georgia, 1988); Craig Hoffmeier, M.D. (Louisiana State, 1986) Chapel Hill, NC; Kevin P. Howard, M.D. (Wayne State, 1982) Reidsville, NC; Diane C. Hudson, M.D.; (Missouri-Columbia, 1987) Newton Grove, NC; Rosemary Jackson, M.D., M.P.H. (North Carolina at Chapel Hill, 1980, 1989); David C. Jones, M.D. (Duke, 1979), Mebane, NC; Thomas F. Koinis, M.D. (Case Western, 1980) Fayetteville, NC; Eugenie M. Komives, M.D. (Harvard, 1985) Durham,



NC; Frank W. Leak, M.D. (North Carolina at Chapel Hill, 1967), Clinton, NC; Glen R. Liesegang, M.D. (Kentucky, 1983) Blowing Rock, NC; John R. Mangum, M.D. (North Carolina at Chapel Hill, 1981) Sanford, NC; James S. McGrath, M.D. (Tulane, 1980) Durham, NC; Jennie A. McLaurin, M.D. (Bowman Gray, 1985) Newton Grove, NC; L. David Nave, Jr., M.D. (Bowman Gray, 1981) Sanford, NC; Susan C. Nelson, M.D. (Texas at Houston, 1985) Oxford, NC; J.T. Newton, M.D. (North Carolina at Chapel Hill, 1981), Clinton, NC; Sandra J. Newton, M.D. (Wayne State, 1984), Durham, NC; Malcolm H. Pannill, B.H.S. (Bowman Gray, 1988), Fayetteville, NC; Latham C. Peak, M.D. (Bowman Gray, 1951), Clinton, NC; Gwendolyn Powell, M.D. (Miami, 1981), M.P.H. (North Carolina at Chapel Hill, 1986), Durham, NC; Sarah Cornwell Ringel, M.D. (Duke, 1985) Durham, NC; Paul W. Sasser, M.D. (California at Los Angeles, 1984) Eden, NC; Roberta L. Scherr, M.D. (Hahnemann Univ, 1987) Mt. Holly, NJ; Deborah Smith, M.S.W. (North Carolina at Chapel Hill, 1979), Durham, NC; Greg Stave, M.D. (Duke, 1984) J.D. (Duke, 1984) M.P.H. (North Carolina at Chapel Hill, 1989), R.T.P., NC; Philip E. Stover, M.D. (Eastern Virginia, 1980) Louisburg, NC; Dennis O'G. Stuart, M.D. (Med. Coll. of Virginia, 1982) Elkin, NC; Jane Sutter, M.D. (UCSF, 1983) Hillsborough, NC; Eugene Wade, M.D. (Howard, 1981) Burlington, NC; Jon V. Warkentin, M.D. (Indiana, 1988) Garner, NC; Douglas Watson, Ph.D. (North Carolina at Chapel Hill, 1993); Scott E. Woods, M.D. (Cincinnati, 1987) Durham, NC.

Emeriti: Arthur C. Christakos, M.D.; E. Harvey Estes, Jr., M.D.; Siegfried H. Heyden, M.D.; Dorothy E. Naumann, M.D.; Max Woodbury, Ph.D.

## Required Course

**CFM-205C. Family Medicine.** This basic course in family medicine consists of an eight-week clinical clerkship in the second year. The course's goal is to provide students with an understanding of the principles of family medicine and of how these principles apply in community practice. The course emphasizes continuous and comprehensive health care for people of both sexes and all ages within the context of their social groups and communities. Particular attention is paid to the diagnosis and treatment of common medical problems and to health maintenance, ambulatory care, continuity of care and the role of consultants in primary care. Other topics covered include social factors, such as the doctor-patient relationship and the role of the physician in the community, and the economics of health care delivery.

The clerkship is divided into two parts. During the first half, students are placed with community-based faculty who are practicing family physicians in communities outside of Durham, principally within North Carolina. Many of these preceptorship sites are in rural communities, providing students with exposure to many issues of rural health care such as farming and other occupational injuries, transportation difficulties, and local customs. Students gain extensive experience in diagnosing and managing patient problems in an ambulatory care setting under the guidance of the department's faculty. In addition, the preceptorship provides students with opportunities to see patients in a variety of other settings, including office, home, nursing home, and community hospital.

For the second half of the clerkship, students are based with full-time family medicine faculty on campus. This segment provides continued primary care clinical experience, as well as intensive training in health maintenance and disease prevention. Students review the recommendations from the U. S. Preventive Services Task Force, and develop the skills necessary to provide patients with quality health maintenance care. The students learn counseling skills in nutrition, exercise, safe sex practices, and smoking and alcohol cessation. Didactic sessions cover screening tests and immunizations, along with the epidemiologic background for evaluating these practices. Students also visit various community sites which offer health maintenance.

The on-campus component provides considerably more structured instruction, while the off-campus preceptorship provides a more "real life" experience in the practice of medicine in the community. The two components supplement each other, and together offer the student a broad exposure to ambulatory care and a realistic perspective on medicine and its relation to other important institutions in the community. They also provide a basis for understanding the interdependent relationships between community and referral center physicians. Weight: 8. *V. Johnson*



**CFM-207C. Family Medicine Preceptorship.** This course is identical to the preceptorship component of CF M-205, described above. Each student has a choice of either CF M-205 or a combination of CF M-207 and MED-207, the four-week neurology clerkship. Weight: 4. *V. Johnson*

### **Basic Science Electives**

**CFM-236B. Digital Computers and Their Application in Ambulatory Care.** For students desiring an intensive exposure to medical computer application. The flexible format of the course permits a variety of projects in computer medicine. Examples include projects in medical data bases; interactive patient interviewing; computer-aided instruction; patient/MD education/data collections, organization, retrieval, display and analysis; and MD assist programs. Opportunities exist for activities at the Duke Family Medicine Center in Durham, Duke/FAHEC Family Medicine Center in Fayetteville and other sites. Prerequisite: permission of instructor. Weight: 1-8 Max: 5. *Hammond, Michener, and Blackwell*

**CFM-238B. Tutorial in Community and Family Medicine.** An eight week, individually arranged experience in which the student participates in the research program of a faculty member. The subject matter, course weight, and meeting time is arranged with the faculty member. Each student meets regularly with his faculty preceptor and carries out a project related to the preceptor's work. Through these discussions and the project, the student is able to develop an understanding of the discipline involved. Possible areas include health education, geriatrics, family dynamics, occupational health, health assessment, medical education, management sciences, economic aspects of health care, computer technology, biostatistics and epidemiology, clinical decision making, diagnosis and management of common problems, alcoholism and social support systems. Because of the variety of projects available and the necessity of prior arrangements, it is essential that interested students consult with instructor and staff at least two months before the beginning of the term selected. Prerequisite: permission of instructor. Weight: 1-16. *Parkerson and staff*

**CFM-239B. Principles of Epidemiology.** The purpose of this course is to provide students with an introduction to epidemiology with emphasis on types of community and clinical epidemiologic studies as well as the findings from these studies. The types of studies reviewed include community surveys, case-controlled clinical studies, longitudinal studies, community-based intervention studies, pharmacoepidemiology, and clinical-based intervention studies. Substation areas covered include cardiovascular diseases, cancer, infectious diseases, psychiatric and neurological disorders, diseases of childhood and late life, and the application of epidemiology to preventive medicine. The course is taught in both lecture and discussion group format. Students are presented with a study to critique each week. Grades are assigned based on two objective tests and a review paper. Weight: 4 Max: 15. *Blazer*

**CFM-246B. Historical Studies in a Medical Specialty.** This elective is offered primarily to those who have made the choice of their probable career specialty. It is intended to provide an appreciation of the developments in that specialty and thereby deepen an understanding of it. While the choice of elective topic is made on an individual basis and depend on the interests of each student, emphasis generally is placed on specific theoretical, practical, and organizational developments since the second half of the 19th century. The format comprises selected readings, tutorials, and a student project. Weight: 1-2. *English and Gifford*

**CFM-247B. Medicine in America.** The historical development of the medical profession in the United States with attention to such topics as the changing basis of authority for medical practice, the education of physicians, the impact of science and technology on health care, physician-patient relations, the organization of the profession

as a whole and by specialty, the emergence of the hospital, the role of government in health care delivery and contemporary criticisms of the health care system. The history of the Duke University Medical Center provides a recapitulation of course themes. Additional units of credit may be earned through independent study. Weight: 1. *Gifford*

**CFM-248B. The Development of and Perspectives on Modern Medicine.** Comprised of lectures, discussion, and readings, this course outlines the general history of medicine with particular attention given to recent developments. The course includes such topics as the contributions of William Harvey, medical systems, aspects of clinical diagnosis, and the evolution of key concepts in modern medicine such as cell theory, the germ theory, antisepsis, and theories of immunity. Full use is made of the excellent resources of the Trent Collections. Additional unit of credit may be earned through independent study. Weight: 1. *Gifford*

### **Clinical Science Electives**

**CFM-214C. Rural Health Elective.** Through a seminar series and experiences working in a community-sponsored rural health clinic, students begin to understand the forces that impact health and health care in rural North Carolina. The seminar series includes speakers and discussion on such topics as the economics of health care, health education, worker health, environmental health, cultural and ethical bias in health care and community action for health care workers. Students organize volunteer staffing for the Fremont clinic, and orient and teach other students. Students should have volunteered for the North Carolina Student Rural Health Coalition in either year one or year two. The grade for this year-long course is posted at the end of the second term. One credit per term is awarded. C-L: MED 214C. Weight: 2 Min: 1 Max: 10. *B. Sheline*

**CFM-250C. Clinical Nutrition.** This course provides an overview and opportunity to develop skills in the assessment and management of common nutritional problems in primary care. Topics include nutritional assessment; nutrition during pregnancy and lactation, infancy and childhood, as well as senescence; nutritional management of chronic diseases (diabetes, obesity, cardiovascular disease); health promotion/disease prevention. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Max: 8. *Adams*

**CFM-254C. Community Medicine Elective.** This elective combines patient care with study of community health issues and population-based approach to treatment. Students develop an intervention plan for a problem they perceive and that is perceived by the community. Student also practice study design and implementation via a quality assurance project. This elective is held in Madison County in western North Carolina. Weight: 3 Max: 1. *B. Sheline and staff*

**CFM-255C. Health Promotion and Disease Prevention.** This elective is an intensive clinical experience in health promotion and disease prevention. Students see patients in the Duke Family Medicine Center, and participate in a variety of activities designed to help them provide excellent health maintenance care. Specific content areas addressed include counseling skills in nutrition, safe sex practices, and smoking and alcohol cessation, as well as screening tests and immunizations. Weight: 4 Min: 2 Max: 6. *Yarnall and staff*

**CFM-256C. Ethical Issues in Medicine.** This seminar examines ethical questions raised by modern biomedical science and technology with special attention to their implications for primary care practitioners. It offers both historical and systematic analysis and attend to models of physician-patient relationships. Among topics for consideration are ethical method (resource allocation, justice, and public policy), medical beneficence, and concepts of rights together with selected practice-related issues (e.g., truth-telling, confidentiality, abortion, contraception, consent, definition and meaning



of death, behavior modification). If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 2 Max: 10. *H. Smith*

**CFM-257C. Philosophic Problems for Physicians.** This seminar is designed to help the fourth year medical student prepare for becoming an intern/resident in the areas of dealing with patients: taking on that level of responsibility, telling the family/patient about serious illness or about the patient's terminal condition, working with a family at the time of death, and dealing personally and professionally with the kinds of pressures placed on the intern/resident (how to do more than survive the next three to five years, keeping marriage together, being a parent, etc.) Prerequisite: permission of the instructor. If permitted by the instructor, this clinical science course can be audited. Weight: 2 or 4 Min: 3 Max: 8. *Puckett and staff*

**CFM-258C. Legal Issues in Medicine.** A seminar which introduces participants to the basic approach of law and legal process to contemporary issues in medical care including malpractice, hospital privileges, confidentiality, natural death, abortion, consent/authorization for treatment, human experimentation, and peer review. Topics may be chosen by individual students. Common misconceptions about malpractice law and the rights of physicians and patients as well as the legal mechanisms for resolving disputes are examined including the role of expert witnesses. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Min: 5 Max: 20. *Warren*

**CFM-259C. Advanced Clerkship in Family Medicine.** This course provides intensive instruction and practice in the care of primary care patients in the community setting. Students may select from two sites: the Duke Family Medicine Center on the Duke campus or the Duke-FAHEC Family Medicine Center in Fayetteville. This course has an outpatient focus and is recommended for students who would like to improve their skills in the care of ambulatory patients, especially those with common problems. Students are involved with day to day patient care under the supervision of family physician faculty and residents. Because of restrictions on the number of students allowed at each site, students are advised to contact the department as early as possible for course approval (at least eight weeks in advance). **No drops are permitted within sixty days of the first day of the rotation.** Prerequisites: permission of instructor. Weight: 2-8 Max: 4. *Andolsek and staff*

**CFM-260C. Subinternship in Family Medicine.** This course provides senior medical students with an intense inpatient clinical rotation with responsibilities and autonomy similar to that of an intern. The student acts as the primary medical provider for inpatients on the Family Medicine service in Duke Hospital and follow outpatients at the Duke Family Medicine Center in the setting of a residency program. Clinical instruction and supervision on each patient encounter are afforded by senior level housestaff and faculty members of the Department of Community and Family Medicine. Individual reading on patient problems encountered in the daily work routine is expected. Frequent balanced feedback is provided to students. Students are advised to contact the department as early as possible for course approval (at least eight weeks in advance). **No drops are permitted within sixty days of the first day of the rotation.** Prerequisites: permission of instructor. Weight: 4 Max: 1. *Nadler and staff*

**CFM-261C. Family Medicine Continuity Experience.** Students manage a panel of patients over an extended period of time at the Duke Family Medicine Center under the supervision of family physician faculty and fellows. Patient care is scheduled for one to two half days a week for two to four months. The rotation may be repeated to provide further continuity. A student project is also required. Due to the need for clinic schedule arrangements, students are advised to contact the department as soon as possible for course approval (at least eight weeks in advance). Prerequisites: permission of instructor. Weight: 2-8. *V. Johnson and staff*



**CFM-262C. Clerkship in Occupational Medicine.** The Division of Community and Occupational Medicine, of Duke Medical Center is offering a one to two month clerkship in occupational medicine. This clerkship is flexible and can offer programs, the management of occupational health services, and the care and evaluation of workers exposed to various chemical and physical agents. Seminars during the rotation can cover such topics as industrial toxicology, ergonomics, physiological stress in the work place, legal and ethical issues in occupational medicine and health promotion. Weight: 3-8 Max: 2. *Stopford, Stenberg, G. Jackson, Thomann, and Greenberg*

**CFM-267C. Metamorphosis through Diet and Exercise.** The student learns the team approach in the education and treatment of patients with weight management problems associated with dysfunctional lifestyle in settings where a variety of health professionals, including physicians, physician assistants, nurses, psychologists, nutritionists, and exercise physiologists are utilized. Direct observation, participation in clinical services, assigned readings, and tutorials are the teaching strategies used. Prerequisite: permission of instructor. Weight: 4-8 Max: 1. *Hamilton, Kolotkin, Alphin, and Keating*

**CFM-271C. The Computer Textbook of Medicine.** Students participate in the ongoing development of a computerized database in cardiovascular disease. They participate in research concerning the diagnosis, treatment, and prognosis of patients with coronary artery disease. And, they learn how to make predictions about outcome based on test results of patients on the cardiology service. Prerequisite: permission of instructor. Weight: 2-4 Max: 5. *Pryor, Califf, Lee, and Harrell*

**CFM-273C. The Ideal Physician.** What is the role of the physician in relating with patients? How do you communicate with patients and families? How well do you do this? What is your "bedside manner"? How do you learn about this other than through models and self-reflection? This seminar provides a small group atmosphere for learning more about such skills and for receiving direct feedback on your own communication style and skills. If allowed by instructor, this clinical science course can be audited. Prerequisite: permission of instructor. Weight: 1-2 Min: 3 Max: 8. *Puckett and staff*

**CFM-274C. The Ideal Patient.** Who is the "ideal" patient? What about those who are not so ideal? This seminar combines theory and practice. Information about "difficult" personality types and effective interpersonal skills for dealing with these individuals are integrated into actual practice. Members of the seminar are asked to draw upon past and current experiences with difficult persons and situations as well as to focus on case presentations provided by the instructor. If permitted by the instructor, this clinical science course can be audited. Prerequisite: permission of instructor. Weight: 1-2 Min: 3 Max: 8. *Puckett and staff*

**CFM-299C. Community and Family Medicine Preceptorship.** An individually tailored preceptorship is arranged for students to work with a family physician in a community practice site almost anywhere. The rotation allows students to observe and participate in the delivery of health care to individual patients and their families within the context of the community in which they live. The rotation is intended to supplement and complement the second year core clerkship. A wide variety of geographic locations and practice types are available; students may choose from an extensive list or nominate a new site. Because of the necessity for prior arrangements with preceptors, it is essential that interested students contact the instructor as soon as possible and at least three months prior to the desired term. **Drops are not accepted.** Prerequisites: permission of instructor. Weight: 4. *V. Johnson and staff*

## **ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS**

**CFM 243B. Occupational Medicine**

CFM 244B. Seminars In Occupational Medicine and Toxicology  
CFM 263C. Family and Psychological Aspects of Medicine

## DIVISION OF BIOMETRY AND MEDICAL INFORMATICS

**BMI-211B. Probability and Statistical Inference.** Laws of probability, probability distributions, descriptive statistics, graphical displays of relationships, philosophy of statistical tests, tests for differences in central tendency, paired comparisons, and correlation. Parametric and nonparametric procedures. Simple linear regression and one way analysis of variance. Weight: 4. *Staff*

**BMI-212B. Design of Etiological, Clinical, and Experimental Studies.** General principles and issues of study design. Observational studies, including descriptive (correlational, case report, cross-sectional) studies, cohort and case-control designs, their relative advantages, and statistical methods used in their analysis. Classical designs (parallel group, randomized block, and cross-over) are surveyed. Introduction to controlled clinical trials and to sequential design strategies. Ethical considerations are discussed. Prerequisite: BMI 211B. Weight: 3. *Feussner*

**BMI-222B. Statistical Programming in SAS.** Creating, manipulating, and analyzing research data using SAS. Prerequisite: BMI 211B (can be taken concurrently) and experience with PC-DOS. Weight: 2. *Staff*

**BMI-399B. Preceptorship in Biometry.** An individualized research program under the direction and supervision of a member of the faculty of the Biometry Study Program. Weight: 1-16. *Wilkinson and staff*

## Genetics

Professor Joseph R. Nevins, Ph.D. (Duke, 1976), *Chairman*.

Professor: Bryan R. Cullen, Ph.D. (New Jersey Medical School, 1984).

Assistant Professors: Laura I. Davis, Ph.D. (Rockefeller, 1987); Joseph Heitman, M.D., Ph.D. (Cornell, 1992, Rockefeller, 1989); Douglas A. Marchuk, Ph.D. (Chicago, 1985); Andrew S. Peterson, Ph.D. (Harvard, 1988); Robin P. Wharton, Ph.D. (Harvard, 1986).

### Required Course

**GEN-200B. Genetics.** A course designed for first year medical students that focuses on the principles of genetics as they apply to human disease. The course emphasizes basic aspects of molecular genetics, experimental genetics and human genetics. Weight: 2. *Nevins*

### Electives

**GEN-215. Genetic Mechanisms.** A comprehensive treatment of molecular and classical genetic mechanisms, emphasizing gene structure and function, genetic analyses in various experimental systems, as well as the behavior of chromosomes in replication, segregation, and recombination, 4 units. *Nevins, Webster, and staff*

## Immunology

Professor Thomas F. Tedder, Ph.D. (Alabama, 1984); *Chairman*.

Professors: Rebecca H. Buckley, M.D. (North Carolina at Chapel Hill, 1958); Jeffrey R. Dawson, Ph.D. (Case Western Reserve, 1969); Barton F. Haynes, M.D. (Baylor, 1973); David R. McClay, Jr., Ph.D. (North Carolina at Chapel Hill, 1971); David S. Pisetsky, Ph.D. (Albert Einstein, 1972); Jeffrey L. Platt, M.D. (Southern California, 1977); Wendell F. Rosse, M.D. (Chicago, 1958); Hilliard F. Seigler, M.D. (North Carolina at Chapel Hill, 1960); Ralph Snyderman, M.D. (State Univ. of New York, 1965); Frances E. Ward, Ph.D. (Brown, 1965).

Associate Professors: Ralph R. Bollinger, M.D. (Tulane, 1970); Eli Gilboa, Ph.D. (Weizmann Institute, 1977); Michael S. Krangel, Ph.D. (Harvard, 1982); Harvey J. Sage, Ph.D. (Yale, 1958).

Associate Research Professors: Andrew E. Balber, Ph.D. (Rockefeller, 1971); Kay H. Singer, Ph.D. (Duke, 1977).

Assistant Professors: Charles E. Buckley III, M.D. (Duke, 1954); Carolyn Doyle, Ph.D. (New York at Stony Brook, 1985); Robert Endres, Ph.D. (Arizona, 1976); Donald L. Granger, M.D. (Utah, 1972); Russell P.

Hall, M.D. (Missouri, 1975); Maureane Hoffman, M.D., Ph.D. (Iowa, 1982); Roger J. Kurlander, M.D. (Chicago, 1971); Mary Louise Markert, M.D. (Duke, 1982), Ph.D. (Duke, 1981).

Assistant Research Professors: Pablo Engel, M.D. (Univ. of Barcelona, 1984), Ph.D. (Univ. of Barcelona, 1991); Donna D. Kostyu, Ph.D. (Duke, 1979).

Research Associates: P. Alford, Ph.D.; M. Brickman, Ph.D.; A. Chen, Ph.D.; A. Colosia, Ph.D.; J. Dul, Ph.D.; M. Gaubitz, Ph.D.; J. McIlvain, Ph.D.; C. Hernandez- Munain, Ph.D.; W. Koopmann, Ph.D.; C. LaBranche, Ph.D.; P. Lauzurica, Ph.D.; L. Lowen, Ph.D., A. Malyguine, Ph.D.; P. Pizcueta, Ph.D.; J. Riberdy, Ph.D.; J. Roberts, Ph.D.; R. Selvan, Ph.D.; L. Zhou, M.D.

Emeriti: James B. Duke Professor D. Bernard Amos, M.D. (Guy's Hospital, London, 1963); Richard S. Metzgar, Ph.D. (Buffalo, 1959).

## Required Courses

**IMM-201B. Immunology.** A short core course in immunology for first-year medical students. The course includes a general introduction to special areas of immunology such as immunochemistry, immunohematology, and immunogenetics including transplantation and tumor immunology. The initial lectures describe the properties of antibodies, the characteristics of antigens, classes of reactive lymphocytes and accessory cells, the biology of cytokines and the complement system. The course is enriched with patient oriented rotein sessions and by discussion groups. Weight: 2. *Dawson*

## Electives

**IMM-252B. General Virology and Viral Oncology.** The first half of the course is devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with tumor viruses which are discussed in terms of the virus-cell interaction, the relationship of virus infection to neoplasia, and the application of retroviruses in molecular and developmental biology. Permission of the instructors is required. C-L: MIC 252B; Graduate School. Weight: 4 Min: 5. *Keene, Joklik, Bastia, Kreuzer, Ostrowski, Linney, Nevins, and Pickup*

**IMM-291B. Comprehensive Immunology.** An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and non-specific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses, neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T cell receptor. C-L: MIC 291B; Graduate School. Weight: 4: Max: 10. *Krangel and staff*

**IMM-330B. Medical Immunology.** A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable the classes include patient presentations and laboratory demonstrations. C-L: MIC 330B; Graduate School. Weight: 5. *F. Ward and staff*

**IMM-399B. Preceptorship in Immunology.** An individual reading and/or laboratory course in specialty areas supervised by an individual faculty member. Acceptance, nature of topic, and amount of credit by individual arrangement with proposed faculty member. Prerequisites: to be determined by instructor. Weight: 1-16. *Staff*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

IMM 259B. Molecular Biology I: Proteins and Enzymes

IMM 268B. Molecular Biology II: Nucleic Acids

IMM 269B. Advanced Cell Biology

IMM 304B. Molecular Membrane Biology



# Medicine

James B. Duke Professor Joseph C. Greenfield, Jr., M.D. (Emory, 1956), *Chairman*.

## DIVISION OF ALLERGY, CRITICAL CARE, AND RESPIRATORY MEDICINE

Professor: James D. Crapo, M.D. (Rochester, 1971), *Chief*.

Professors: C. Edward Buckley, M.D. (Duke, 1954); Harold R. Rotman, M.D. (Univ. of Toronto, 1958); Herbert A. Saltzman, M.D. (Jefferson, 1952); Stephen L. Young, M.D. (California at San Francisco, 1968).

Research Professor: Fredrick J. Miller, Ph.D. (North Carolina State, 1977).

Visiting Professor of Medicine: Werner Hofmann, Ph.D. (University of Vienna, 1973).

Associate Professors: William J. Fulkerson, M.D. (North Carolina at Chapel Hill, 1977); Neil R. MacIntyre, M.D. (Cornell, 1972); Claude Piantadosi, M.D. (Johns Hopkins, 1975).

Associate Research Professor: Robert R. Mercer, Ph.D. (North Carolina at Chapel Hill, 1982).

Assistant Professors: Phillip J. Fracica, M.D. (New York, Downstate, 1981); Andrew J. Ghio, M.D. (Boston Univ., 1981); Y. C. Tony Huang, M.D. (National Taiwan, 1983); Douglas G. Kelling, M.D. (Harvard, 1972); Peter S. Kussin, M.D. (Mount Sinai, 1985); Wayne M. Samuelson, M.D. (Utah, 1980); Mark P. Steele, M.D. (Illinois, 1982); Victor F. Tapson, M.D. (Hahnemann, 1982).

Assistant Research Professors: Barbara Buckley, Ph.D. (Johns Hopkins, 1985); Ling-Yi Chang, Ph.D. (North Carolina State, 1982); Anjilvel Satish, Ph.D. (New York Univ. 1984).

Associates in Medicine: Michael L. Russell, M.D. (North Carolina at Chapel Hill, 1985); Steven G. Simonson, M.D. (Med. Coll. of Wisconsin, 1986); Karen Welty, M.D. (Duke, 1986).

Instructor: Jonathan Stamler, M.D. (Mt. Sinai, 1985).

## DIVISION OF CARDIOLOGY

Professor: Gary L. Stiles, M.D. (Vanderbilt, 1975), *Chief*.

Professors: Thomas M. Bashore, M.D. (Ohio, 1972); Victor S. Behar, M.D. (Duke, 1961); Fred R. Cobb, M.D. (Mississippi, 1964); Walter L. Floyd, M.D. (Johns Hopkins, 1954); James B. Duke Professor Joseph C. Greenfield, Jr., M.D. (Emory, 1956); Joseph R. Kisslo, M.D. (Hahnemann, 1967); Yi-Hong Kong, M.D. (Natl. Defense Med. Ctr., Taiwan, 1958); James B. Duke Professor Robert J. Lefkowitz, M.D. (Columbia, 1966); James J. Morris, M.D. (State Univ. of New York, 1959); Robert H. Peter, M.D. (Duke, 1961); Edward S. Orgain Professor of Medicine Harold C. Strauss, M.D. (McGill, 1964); Robert E. Whalen, M.D. (Cornell, 1956).

Associate Professors: Robert M. Califf, M.D. (Duke, 1978); Augustus O. Grant, M.D. (Edinburgh, 1971); Michael B. Higginbotham, M.D. (Univ. of Melbourne, 1973); Harry R. Phillips, M.D. (Duke, 1975); David B. Pryor, M.D. (Michigan, 1976); Robert A. Rosati, M.D. (Duke, 1967); Richard S. Stack, M.D. (Wayne State, 1976); Galen S. Wagner, M.D. (Duke, 1965); Robert Waugh, M.D. (Pennsylvania, 1966).

Associate Research Professors: Judith C. Rembert, Ph.D. (North Carolina at Chapel Hill, 1972); William M. Smith, Ph.D. (Duke, 1970).

Assistant Professors: Brian H. Annex, M.D. (Yale, 1985); Robert P. Bauman, M.D. (Wayne State, 1977); Stephen C. Culp, M.D. (Vermont, 1986); Stephen M. Denning, M.D. (Duke, 1980); Donald F. Fortin, M.D. (Massachusetts, 1984); David J. Frid, M.D. (Maryland, 1980); Samuel E. George, M.D. (Washington Univ. 1980); Christopher B. Granger, M.D. (Connecticut, 1984); Ruth Ann Greenfield, M.D. (Duke, 1985); J. Kevin Harrison, M.D. (New York Univ., 1984); James G. Jollis, M.D. (Ohio, 1986); L. Allen Kindman, M.D. (Mount Sinai, 1983); William E. Kraus, M.D. (Duke, 1982); Mitchell W. Krucoff, M.D. (George Washington, 1980); Daniel B. Marks, M.D. (Tufts, 1978); Christopher M. O'Conner, M.D. (Maryland, 1983); E. Magnus Ohman, M.D. (Royal Coll. of Surgeons, 1981); Jose A. Perez, M.D. (Southwestern, 1982); Kevin G. Peters, M.D. (Iowa, 1983); Michael H. Sketch, M.D. (Creighton, 1984); Robert A. Sorrentino, M.D. (Albany Med. Coll. 1985); Martin J. Sullivan, M.D. (Ohio State, 1980); James Tchong, M.D. (Johns Hopkins, 1988); J. Marcus Wharton, M.D. (Vanderbilt, 1980); James P. Zidar, M.D. (Loyola, 1985).

Assistant Research Professors: Jack T. Cusma, Ph.D. (Wisconsin, 1983); Mark E. Olah, Ph.D. (Ohio, 1988); Zenghua Su, Ph.D. (The Second Med. Coll., 1970); Yuri Zilberter, Ph.D. (Moscow Univ., 1983).

Associates: Julie K. Feters, M.D. (Ohio, 1986); Terry L. Forrest, M.D. (Indiana, 1986); Neil J. Freedman, M.D. (Harvard, 1985); Robert A. Harrington, M.D. (Tufts, 1986); Sheila Kim Heinle, M.D. (Pittsburgh, 1986); James G. Jollis, M.D. (Ohio, 1986); J. Jay Merrill, M.D. (Washington, 1986); L. Kristin Newby, M.D. (Indiana, 1987); David J. Wendt, M.D. (Wayne State, 1982).

Visiting Associate in Medicine: Raye L. Bellinger, M.D. (Southwestern, 1982).

## DIVISION OF CLINICAL PHARMACOLOGY

Professor: Edward L. C. Pritchett, M.D. (Ohio, 1971), *Chief*.

## DIVISION OF DERMATOLOGY

J. Lamar Callaway Professor of Dermatology Sheldon R. Pinnell, M.D. (Yale, 1963), *Chief*.

Associate Professors: Russell P. Hall, M.D. (Missouri, 1975); Elise A. Olsen, M.D. (Baylor, 1978).

Assistant Professors: Claude S. Burton, M.D. (Duke, 1979); Robert E. Clark, M.D. (Texas, 1985); Virginia A. Lightner, M.D. (Duke, 1982); Neil S. Prose, M.D. (New York Univ., 1975); M. Joyce Rico, M.D. (Florida, 1981).

Assistant Research Professor: Heather N. Yeowell, Ph.D. (North Carolina at Chapel Hill, 1982).  
Assistant Research Associates: Douglas J. Darr, Ph.D. (Pennsylvania State, 1982); Saood Murad, Ph.D. (California at Davis, 1978).  
Associate: Sarah C. Myers, M.D. (Duke, 1989).

## **DIVISION OF ENDOCRINOLOGY, METABOLISM, AND NUTRITION**

Professor Marc K. Drezner, M.D. (Pittsburgh, 1970), *Chief*.  
Professors: Perry J. Blackshear, M.D. (Harvard, 1977); Mark N. Feinglos, M.D. (McGill, 1973).  
Associate Professors: Warner M. Burch, M.D. (Bowman Gray, 1971); Richard V. Clark, M.D. (Washington, 1977); George J. Ellis, M.D. (Harvard, 1963); Jerome M. Feldman, M.D. (Northwestern, 1961); John R. Guyton, M.D. (Harvard, 1973); Charles Johnson, M.D. (Howard, 1963); Keith Parker, M.D. (Washington Univ., 1981).  
Associate Research Professors: Bruce Lobaugh, Ph.D. (Pennsylvania State, 1981); Teresa Nesbitt, Ph.D. (Duke, 1986).  
Assistant Professors: Michael J. Econs, M.D. (California at San Francisco, 1983); Kristine D. Harper, M.D. (Michigan State, 1980); Diana B. McNeill, M.D. (Duke, 1982).  
Assistant Research Professor: Deborah J. Stumpo, Ph.D. (West Virginia, 1984).  
Associates: Leslie J. Domalik, M.D. (Pittsburgh, 1986); Michael J. Thompson, M.D. (Massachusetts, 1986).

## **DIVISION OF GASTROENTEROLOGY**

Professor: Rodger A. Liddle, M.D. (Vanderbilt, 1978), *Chief*.  
Professors: Peter B. Cotton, M.B. (St. Thomas Hosp., 1963); Joseph W-C. Leung, M.D. (Univ. of Hong Kong, 1975); Michael McLeod, M.D. (Duke, 1960).  
Associate Professors: J. Gregory Fitz, M.D. (Duke, 1979); John T. Garbutt, M.D. (Temple, 1962); Paul G. Killenberg, M.D. (Pennsylvania, 1963); Thomas T. Long, M.D. (Bowman Gray, 1966); Steven H. Quarfordt, M.D. (New York Univ., 1960); Joanne A. P. Wilson, M.D. (Duke, 1973).  
Assistant Professors: John Affronti, M.D. (George Washington, 1985); John Baillie, M.B. (Glasgow Univ., 1977); M. Stanley Branch, M.D. (Med. Coll. of Georgia, 1984); Scott R. Brazer, M.D. (Case Western Reserve, 1981); Jonathan A. Cohn, M.D. (Rockefeller, 1978); Christine M. Hunt, M.D. (Boston Univ., 1982); Paul S. Jowell, M.D. (Univ. of Capetown, 1983); James M. McGill, M.D. (Ohio, 1986); Peter J. Mannon, M.D. (Boston Univ., 1983); Dawn Provenza, M.D. (Albany, 1984).  
Assistant Research Professor: Sheila Collins, Ph.D. (M.I.T., 1985).  
Associates: Kevin J. Cosey, M.D. (Case Western Reserve, 1987); Steven A. Guarisco, M.D. (Louisiana, 1986); Allen W. Mangel, M.D. (Georgetown, 1988); Jane E. Onken, M.D. (George Washington, 1987); Colleen M. Schmitt, M.D. (South Alabama, 1986); Nicholas D. Snow, M.D. (Ohio, 1985); Diane M. Williams, M.D. (Minnesota, 1987).

## **DIVISION OF GENERAL INTERNAL MEDICINE**

Professor: John R. Feussner, M.D. (Vermont, 1973), *Chief*.  
Associate Professors: Francis A. Neelon, M.D. (Harvard, 1962); David B. Matchar, M.D. (Maryland, 1980); David L. Simel, M.D. (Duke, 1980).  
Associate Research Professor: Morris Weinberger, Ph.D. (Purdue, 1978).  
Assistant Professors: Charles O. Beauchamp, M.D. (Duke, 1975); M. Sue Kirkman, M.D. (North Carolina at Chapel Hill, 1982); Eugene Z. Oddone, M.D. (Colorado, 1985); Harry W. Severance, M.D. (Duke, 1981); Jeremy Sugarman, M.D. (Duke, 1986); James A. Tiesky, M.D. (Illinois, 1987); Jeffrey G. Wong, M.D. (Utah, 1985).  
Assistant Research Professors: Ronnie D. Horner, Ph.D. (Ohio State, 1984); Denise Hynes, Ph.D. (North Carolina at Chapel Hill, 1991).  
Associates: Lori A. Bastian, M.D. (Emory, 1987); John M. Brown, M.D. (Florida, 1984); John J. Dallara, M.D. (Med. Coll. of Virginia, 1987); Lisa A. Giannetto, M.D. (Loyola, 1986); Sharon C. Hathaway, M.D. (Duke, 1987); Faith H. Holcombe, M.D. (Washington Univ., 1980); Stephen P. Kantrow, M.D. (Louisiana, 1988); Lynn E. Keplinger, M.D. (West Virginia, 1990); D. Andrew Knapp, M.D. (California at San Diego, 1984); Lee Wan Liu, M.D. (Maryland, 1984); Douglas C. McCrory, M.D. (Miami, 1986); John L. Morris, M.D. (Ohio State, 1986); John J. Paat, M.D. (Med. Coll. of Ohio, 1984); Bernadette R. Page, M.D. (Loyola, 1970); Paul J. Saba, M.D. (McGill, 1980); Robert W. Paterson, M.D. (Duke, 1979); W. Mark Stanton, M.D. (Mississippi, 1982); Jeannette F. Stein, M.D. (North Carolina at Chapel Hill, 1981); Mark C. Thel, M.D. (Georgetown, 1986); Kathleen A. Waite, M.D. (Duke, 1990); Eric C. Westman, M.D. (Wisconsin, 1986); Joseph E. Williamson, M.D. (North Carolina at Chapel Hill, 1973).

## **DIVISION OF GERIATRICS**

Professor: Harvey Jay Cohen, M.D. (SUNY, 1965), *Chief*.  
Associate Professor: Kenneth W. Lyles, M.D. (Med. Coll. of Virginia, 1974).  
Associate Research Professor: Connie Bales, Ph.D. (Tennessee, 1981).



Assistant Professors: Anthony N. Galanos, M.D. (South Alabama, 1986); Helen Hoenig, M.D. (Arizona, 1985); Gary G. Kochersberger, M.D. (Sackler, 1982); S. Spence McCachren, M.D. (Duke, 1978); Lina-Marie Obeid, M.D. (Beirut, 1983); Kenneth E. Schmader, M.D. (Bowman Gray, 1980).

Assistant Research Professors: Lucille A. Bearon, Ph.D. (Duke, 1982); Elizabeth Clipp, Ph.D. (Cornell, 1984); Melody Hobbins, M.D. (Kentucky, 1982); K. Murali Krishna Rao, Ph.D. (Gandhi Med. Coll., 1968).

Associates: Aline Bohanon, M.D. (New York at Syracuse, 1988); Andrea Hackel, M.D. (Duke, 1981); Paul L. Mulhausen, M.D. (Minnesota, 1987); Debra K. Weiner, M.D. (Missouri, 1983).

Instructor: Elizabeth L. Rogers, M.D. (Jefferson, 1971).

## DIVISION OF HEMATOLOGY-ONCOLOGY

Associate Professor: Russel Kaufman, M.D. (Ohio, 1973), *Chief*.

Professor: Welcome Clinical Professor in Honor of R. Wayne Rundles, M.D. Robert C. Bast, M.D. (Harvard, 1971), *Director, Comprehensive Cancer Center*.

Professors: Andrew T. Huang, M.D. (Taiwan, 1965); Florence McAllister Professor Wendell F. Rosse, M.D. (Chicago, 1958); Harold R. Silberman, M.D. (Washington Univ., 1956); J. Brice Weinberg, M.D. (Arkansas, 1969).

Associate Professors: Thomas D. Brown, M.D. (Med. Coll. of Virginia, 1979); Jeffrey Crawford, M.D. (Ohio State, 1974); Jon P. Gockerman, M.D. (Chicago, 1967); Charles S. Greenberg, M.D. (Hahnemann, 1976); Yusuf A. Hannun, M.D. (American University of Beirut, 1981); James W. Hathorn, M.D. (Duke, 1979); Roger J. Kurlander, M.D. (Chicago, 1971); Joseph O. Moore, M.D. (Johns Hopkins, 1971); Thomas F. Newcomb, M.D. (Pittsburgh, 1951); William B. Peters, M.D. (Columbia, 1978); Marilyn J. Telen, M.D. (New York, 1977).

Assistant Professors: Camille L. Bedrosian, M.D. (Harvard, 1983); Charles L. Bennett, M.D. (Pennsylvania, 1981); Gerold Bepler, M.D. (Philippis Univ., 1983); Scott D. Berkowitz, M.D. (Jefferson, 1979); William Dittman, M.D. (Washington, 1981); Robert L. Fine, M.D. (Chicago, 1979); Kathleen A. Havlin, M.D. (Northwestern, 1982); Atif M. Hussein, M.D. (Beirut, 1982); William H. Kane, M.D. (Washington Univ., 1982); B. Gail Macik, M.D. (Texas at San Antonio, 1983); Thomas L. Ortel, M.D. (Indiana, 1985); George Phillips, M.D. (Duke, 1978); Maureen Ross, M.D. (Miami, 1984); Clayton A. Smith, M.D. (Southwestern, 1984); James J. Vredenburg, M.D. (Vermont, 1983); Eric P. Winer, M.D. (Yale, 1983).

Associate Research Professor: Sandra L. White, Ph.D. (Michigan, 1974).

Assistant Research Professors: Komandoor E. Achyuthan, Ph.D. (Osmania, 1982); Alieja Bielawska, Ph.D. (Tech Univ. Wroclaw, 1975); Cinda M. Boyer, Ph.D. (Pennsylvania, 1980); Donald E. Fleenor, Ph.D. (Emory, 1987); Feng Ji Xu, Ph.D. (Peking Union, 1970).

Associates: Mary E. Albers, M.D. (Indiana, 1986); Lee F. Allen, M.D. (Robert Wood Johnson, 1987); Raymund S. Cuevo, M.D. (Yale, 1986); Carlos de Castro, M.D. (Southwestern, 1985); Marc Gautier, M.D. (Dartmouth, 1986); Andrew W. Pippas, M.D. (Utah, 1986); Peter Rubin, M.D. (Calgary, 1988); Manuel A. Santiago, M.D. (Puerto Rico, 1986); Robert A. Wolff, M.D. (Albany, 1986).

## DIVISION OF INFECTIOUS DISEASES

Professor: John D. Hamilton, M.D. (Colorado, 1964) *Chief*.

Professor: David T. Durack, M.B., B.S. (West Australia, 1969); D.Phil. (Oxford, 1973).

Associate Professors: G. Ralph Corey, M.D. (Baylor, 1973); Harry A. Gallis, M.D. (Duke, 1967); Donald L. Granger, M.D. (Utah, 1972); John Perfect, M.D. (Med. Coll. of Ohio, 1975); Daniel J. Sexton, M.D. (Northwestern, 1971); Kenneth H. Wilson, M.D. (North Carolina at Chapel Hill, 1974).

Assistant Professors: June Almenoff, M.D. (Mt. Sinai, 1985); John A. Bartlett, M.D. (Virginia, 1981); J. Peter Ceglinski, M.D. (California at San Diego, 1984); Carol S. Dukes, M.D. (Utah, 1985); Charles B. Hicks, M.D. (George Washington, 1979); Gunther J. Lallinger, M.D. (Ludwig, 1972); G. Diego Miralles, M.D. (Univ. of Buenos Aires, 1986); Mark D. Perkins, M.D. (Southwestern, 1984).

Assistant Research Professor: Dena L. Toffaletti, Ph.D. (North Carolina at Chapel Hill, 1977).

Associates: Alison E. Heald, M.D. (Yale, 1989); Richard Frothingham, M.D. (Duke, 1981); Jerome H. Kim, M.D. (Yale, 1984).

## DIVISION OF NEPHROLOGY

Professor: William E. Yarger, M.D. (Baylor, 1963), *Chief*.

Professors: James R. Clapp, M.D. (North Carolina at Chapel Hill, 1957); J. Caulie Gunnells, M.D. (South Carolina Med. Coll., 1956); Steve J. Schwab, M.D. (Missouri, 1979).

Associate Professors: John R. Raymond, M.D. (Ohio State, 1982); Laura P. Svetkey, M.D. (Harvard, 1979).

Assistant Professors: Thomas Coffman, M.D. (Ohio, 1980); Roslyn B. Mannon, M.D. (Duke, 1985); John P. Middleton, M.D. (Med. Coll. of Virginia, 1983); L. Darryl Quarles, M.D. (Alabama, 1979); John R. Raymond, M.D. (Ohio State, 1982); Stephen R. Smith, M.D. (Duke, 1985); Robert F. Spurney, M.D. (Ohio, 1983).

Associates in Medicine: Frank J. Albers, M.D. (Cincinnati, 1984); Michael S. Berkoben, M.D. (Pennsylvania, 1986); David W. Butterly, M.D. (Duke, 1987).



## DIVISION OF NEUROLOGY

Jefferson-Pilot Corporation Professor of Neurobiology Allen D. Roses, M.D. (Pennsylvania, 1967), *Chief*.

Professors: Carl R. Deane Professor of Neuroscience James O. McNamara, M.D. (Michigan, 1968); Donald B. Sanders, M.D. (Harvard, 1964).

Associate Professors: Mark J. Alberts, M.D. (Tufts, 1982); Barrie H. Hurwitz, M.D. (Witwatersrand Univ., 1968); Janice M. Massey, M.D. (Georgetown, 1978); Donald Schmechel, M.D. (Harvard, 1974); Warren J. Strittmatter, M.D. (Duke, 1973); Ara Tourian, M.D. (Iowa, 1958).

Assistant Professors: Mark T. Brown, M.D. (Illinois, 1984); James R. Burke, M.D. (New York at Brooklyn, 1985); Nancy L. Earl, M.D. (North Carolina at Chapel Hill, 1982); Larry B. Goldstein, M.D. (Mt. Sinai, 1981); David A. Hosford, M.D. (Emory, 1983); Joel C. Morgenlander, M.D. (Pittsburgh, 1986); Rodney A. Radtke, M.D. (Northwestern, 1980); Marvin Rozear, M.D. (Duke, 1966); Jeffery M. Vance, M.D. (Duke, 1984); Kevan VanLandingham, M.D. (Virginia, 1985).

Assistant Research Professors: John R. Gilbert, Ph.D. (North Carolina at Chapel Hill, 1982); Sanjeev D. Nandedkar, Ph.D. (Virginia 1983).

Associates: Carmelo Graffagnino, M.D. (West-Ontario, 1985); Richard W. Tim, M.D. (California at San Diego, 1986).

Instructor: J. Peter Glass, M.D. (New York Med. Coll., 1972).

## DIVISION OF RHEUMATOLOGY AND IMMUNOLOGY

Professor: Frederic M. Hanes Professor of Medicine Barton F. Haynes, M.D. (Baylor, 1973), *Chief*.

Professors: Michael S. Hershfild, M.D. (Pennsylvania, 1967); Nicholas M. Kredich, M.D. (Michigan, 1962); David S. Pisetsky, M.D. (Albert Einstein, 1973); James B. Duke Professor of Medicine Ralph Snyderman, M.D. (New York, Downstate, 1965); James B. Wyngaarden, M.D. (Michigan, 1948).

Associate Professors: Nancy B. Allen, M.D. (Tufts, 1978); David S. Caldwell, M.D. (Bowman Gray, 1967); John R. Rice, M.D. (Miami, 1968); Michael F. Seldin, M.D. (Baylor, 1981).

Associate Research Professors: Thomas J. Palker, Ph.D. (Connecticut, 1982); Kay H. Singer, Ph.D. (Duke, 1977).

Assistant Professors: Gary S. Gilkeson, M.D. (Southwestern, 1979); Virginia B. Kraus, M.D. (Duke, 1982); Rex M. McCallum, M.D. (Vanderbilt, 1980); Cheryl R. Robertson, M.D. (Kentucky, 1985); E. William St. Clair, M.D. (West Virginia, 1980).

Assistant Research Professors: Hydar Ali, Ph.D. (Univ. Coll. of London, 1986); Bodduluri Haribabu, Ph.D. (Indian Inst., 1984); Hua-Xin Liao, Ph.D. (North Carolina at Chapel Hill, 1991).

Associates: Stephen F. Kingsmore, M.D. (Queens Univ., 1985); M. Richardo Richardson, Ph.D. (Univ. of Barcelona, 1988); Michael R. Saitta, M.D. (Johns Hopkins, 1984).

## ADJUNCT FACULTY

Professor of Experimental Medicine: James E. Nidel, M.D. (Miami, 1973).

Adjunct Professors of Medicine: A. Wallace Hayes, Ph.D. (Auburn, 1967); Calvin A. Lang, Sc.D. (Johns Hopkins, 1954); Nicholas A. Vick, M.D. (Chicago, 1965).

Adjunct Associate Professor of Experimental Medicine: S. Duk Lee, Ph.D. (Maryland, 1961).

Adjunct Associate Professors of Medicine: Fredrick L. Dunn, M.D. (Illinois, 1974); John S. Penta, Ph.D. (Purdue, 1967); Thomas L. Wenger, M.D. (Boston, 1971).

Adjunct Assistant Professors of Medicine: Linda Charles, Ph.D. (North Carolina at Chapel Hill, 1991); Gary E. R. Hook, Ph.D. (Victoria, 1968); Richard Kent, M.D. (California at San Diego, 1975); Raul Lupia, M.D. (Univ. of Salvador, 1983).

Adjunct Assistant Professor of Experimental Medicine: John J. O'Neil, Ph.D. (California at San Francisco, 1974).

## CONSULTING FACULTY

Consulting Professors: David W. Barry, M.D. (Yale, 1969), Research Triangle Park, NC; Vincent Dennis, M.D. (Georgetown, 1966), Cleveland, OH; Robert A. Gutman, M.D. (Florida, 1962), Durham, NC; Eric N. Prystowsky, M.D. (Mount Sinai, 1973), Indianapolis, IN; Barry W. Rame, M.D. (Colorado, 1964), Albuquerque, NM; Eric J. Topol, M.D. (Rochester, 1979), Cleveland, OH.

Associate Consulting Professors: Robert S. Gilgor, M.D. (Pennsylvania, 1962), Chapel Hill, NC.; Harold L. Godwin, M.D. (Harvard, 1947), Fayetteville, NC.

Assistant Consulting Professors: Syed Ahmed, M.D. (Dow Med. Coll., 1967), Danville, VA; Roy M. Ambinder, M.D. (Columbia, 1975); Orlando, FL; Franc A. Barada, M.D. (Virginia, 1971), Durham, NC; Charles F. Bethea, M.D. (Oklahoma, 1971), Oklahoma City, OK; Dean A. Bramlett, M.D. (Illinois, 1976), St. Petersburg, FL; Wayne D. Brenckman, M.D. (Yale, 1963), Durham, NC; J. Trig Brown, M.D. (Washington Univ., 1977), Durham, NC; Gary J. Collins, M.D. (Uniformed Services, 1982), Dayton, OH; Edwin Cox, M.D. (Duke, 1971), Durham, NC; Joan Drucker, M.D. (Virginia, 1980), Durham, NC; Philip H. Dunn, M.D. (Duke, 1976), Orlando, FL; Lewis D. Elliston, M.D. (Baylor, 1969), Asheville, NC; Paul R. Garrett, M.D. (Med. Coll. of Ohio, 1972); F. Roosevelt Gilliam, M.D. (Duke, 1981), Richmond, VA; Albino Gomez-Uria, M.D. (Madrid Sch. of Med.,

1962), Asheville, NC; N. Rebecca Haley, M.D. (Eastern Virginia, 1984), Charlotte, NC; Rochelle M. Hanley, M.D. (Michigan, 1978), Research Triangle Park, NC; Elizabeth Kanof, M.D. (New York Univ., 1960), Raleigh, NC; G. Wallace Kernodle, M.D. (North Carolina at Chapel Hill, 1981), Burlington, NC; William D. Kuehl, M.D. (Iowa, 1982), Asheville, NC; Douglas E. Lemley, M.D. (West Virginia, 1982), Concord, NC; Stewart Levine, M.D. (Columbia, 1978), Asheville, NC; Linville M. Meadows, M.D. (North Carolina at Chapel Hill, 1982), Sanford, NC; Roderick B. Meese, M.D. (Cincinnati, 1981); Tyler, TX; Gwenesta B. Melton, M.D. (Tulane, 1979), Fayetteville, NC; Michael J. Messino, M.D. (Ohio, 1974), Asheville, NC; Frank A. McGrew, M.D. (Case Western Reserve, 1970), Memphis, TN; J. Frederick McNeer, M.D. (Duke, 1972), Tulsa, OK; Lefkos T. Middleton, M.D. (University of Louis Pasteur, 1976), Cyprus, Greece; Robert D. Mitchell, M.D. (Michigan, 1982); Concord, NC; Brant S. Mittler, M.D. (Duke, 1972), San Antonio, TX; Eva L. Morgenstern, M.D. (Connecticut, 1976), Asheville, NC; Rebecca L. Moroosse, M.D. (Connecticut, 1980), Orlando, FL; Gautam K. Patel, M.D. (S.M.T.N.H.L. Municipal Medical Coll., 1976), Asheville, NC;

Robert B. Reynolds, M.D. (Royal College of Surgeons, 1984), Longwood, FL; John B. Simpson, M.D. (Duke, 1973), Woodside, CA; David K. Smith, M.D. (Case Western Reserve, 1974), Orlando, FL; Abe Winston, M.D. (Duke, 1963), Durham, NC; James O. Wynn, M.D. (Cornell, 1951), Chapel Hill, NC; Lee H. Zehngebot, M.D. (Pennsylvania, 1976), Orlando, FL.

Consulting Associates: Fred H. Allen, M.D. (Columbia, 1959), Charlotte, NC; Faye T. Banks, M.D. (Virginia, 1982), Durham, NC; L. Thomas Barber, M.D. (George Washington, 1982), Durham, NC; Habib Bassil, M.D. (St. Joseph, 1980), South Boston, VA; Polly A. Beere, M.D. (Chicago, 1986), West Point, PA; Ira M. Bernstein, M.D. (Bowman Gray, 1970), Asheville, NC; Nayan K. Bhatt, M.D. (Sheffield Univ., 1981), Martinsville, VA; Alan M. Blaker, M.D. (Maryland, 1984), Florence, SC; Garrett Bressler, M.D. (Duke, 1978), Durham, NC; Louis L. Brunetti, M.D. (Mount Sinai, 1983), Charlotte, NC; A. Gray Bullard, M.D. (North Carolina at Chapel Hill, 1985), Sanford, NC; Paul R. Conkling, M.D. (Ohio, 1982), Norfolk, VA; James H. Cooke, M.D. (Duke, 1976), Concord, NC; Chauncey Crandall, M.D. (Univ. Centr de Estudio, Dominican Republic, 1983), West Palm Beach, FL; Gary K. DeWeese, M.D. (Duke, 1986), Burlington, NC; Michael S. Dowling, M.D. (Case Western Reserve, 1983), Durham, NC; Manuel H. Enriquez, M.D. (East-Ramon Magsaysay, 1979), Asheville, NC; William A. Fintel, M.D. (Minnesota, 1983), Salem, VA; Richard Goulah, M.D. (St. George, 1982), South Boston, VA; Robert A. Harrell, M.D. (Johns Hopkins, 1980), Durham, NC; Vasundhara G. Iyengar, M.D. (Bangalore, 1970), Orlando, FL; Dennis C. Kabasan, M.D. (Univ. of Graz, 1977), Asheville, NC; Paul E. Kile, M.D. (Tufts, 1982), Louisburg, NC; Kathryn Kirkland, M.D. (Dartmouth, 1986), Raleigh, NC; Joseph M. Kmonicek, M.D. (Jefferson, 1980), Florence, SC; Gilbert A. Leidig, M.D. (Pennsylvania, 1984), Fort Bragg, NC; Stanley Levy, M.D. (Georgetown, 1971), Durham, NC; Wendy Lu Martin, M.D. (Rush, 1988), Research Triangle Park, NC; Richard N. Lind, M.D. (Illinois, 1977), Asheville, NC; Ralph N. McDonald, M.D. (West Virginia, 1982), Hickory, NC; Michael M. Meighan, M.D. (Univ. of Northeast, 1980), Asheville, NC; Arnold I. Miller, M.D. (Kansas City, 1972), Orlando, FL; Gary P. Miller, M.D. (Virginia, 1976), Danville VA; G. Radford Moeller, M.D. (Duke, 1977), Pollocksville, NC; Jorge G. Otoya, M.D. (Univ. of San Marcos, 1974), Orlando, FL; Alexander Paraschos, M.D. (Med. Coll. of Virginia, 1986), Burlington, NC; Deepak Pasi, M.D. (All India Institute, 1974), Henderson, NC; James E. Pope, M.D. (Eastern Virginia, 1978), Tampa, FL; Robert E. Pryor, M.D. (Baylor, 1986), Galax, VA; Joseph A. Puma, D.O. (New York Coll. of Osteopathy, 1985), Galax, VA; Veronica J. F. Ray, M.D. (North Carolina at Chapel Hill, 1979), Durham, NC; John D. Reed, M.D. (North Carolina at Chapel Hill, 1986), Concord, NC; David F. Rhodes, M.D. (Vanderbilt, 1985), Concord, NC; Paul D. Richards, M.D. (Tulane, 1979), Salem, VA; Michael S. Roberts, M.D. (Tufts, 1979), Orlando, FL; Manfred Rothstein, M.D. (Duke, 1974), Cary, NC; Stephen H. Royal, M.D. (New York, Downstate, 1981), Lumberton, NC; John M. Schillo, M.D. (Maryland, 1981), Asheville, NC; Stuart L. Schnider, M.D. (Case Western Reserve, 1983), Chapel Hill, NC; Roger L. Seagle, M.D. (Bowman Gray, 1979), Morganton, NC; Willie J. Sessions, M.D. (Tufts, 1985), Henderson, NC; Sydney G. Short, M.D. (West Virginia, 1983), Sanford, NC; Robert K. Stack, M.D. (Wayne State, 1981), Charlotte, NC; Thomas A. Steffens, M.D. (Tufts, 1982), Concord, NC; John P. Stratton, M.D. (Harvard, 1961), Durham, NC; Constantine-Dean Tseretopoulous, M.D. (St. George, 1982), Nassau, Bahamas; Janet K. Vasey, M.D. (Indiana, 1983), Asheville, NC; Boshra George Zakhary, M.D. (Ain Shams Univ. 1981), Danville, VA; William J. Zimmer, M.D. (Wisconsin, 1986), Martinsville, VA.

## CLINICAL FACULTY

Clinical Professor: Robert Silber, M.D. (New York, Downstate, 1954).

Associate Clinical Professors: Charles Ellenbogen, M.D. (Chicago, 1964); Paul E. Klotman, M.D. (Indiana, 1976); Malcolm McDonald, M.D. (Univ. of Melbourne, 1973); John C. Murray, M.D. (Duke, 1977).

Assistant Clinical Professors: Mary E. Klotman, M.D. (Duke, 1980); Kenneth Morris, M.D. (Ohio, 1972); Frank Pancotto, M.D. (Chicago, 1975), Concord, NC.

Assistant Clinical Professor in Medicine: Conrad C. Fulkerson, M.D. (Missouri, 1969).

Clinical Associates: Paul T. Campbell, M.D. (Temple, 1985), Concord, NC; Richard B. Everson, M.D. (Rochester, 1972), Research Triangle, Park, NC; Colleen J. C. Gilbert, Ph.D. (North Carolina at Chapel Hill, 1993) Duke; Douglas L. Hill, M.D. (Vanderbilt, 1987), Concord, NC; Robert L. Jobe, M.D.



(North Carolina at Chapel Hill, 1987), Concord, NC; David F. Lobach, M.D. (Duke, 1987), Duke; E. Wayne Massey, M.D. (Texas at Galveston, 1970), Duke; William P. Petros, Ph.D. (Philadelphia Coll. of Pharm., 1987); Thomas F. Trahey, M.D. (Bowman Gray, 1984), Concord, NC.

Emeriti: Albert Heyman, M.D.; Jacqueline C. Hijmans, M.D. (Univ. of Leiden, 1951); Walter Kempner, M.D.; Johannes A. Kylstra, M.D.; Harry T. McPherson, M.D.; Barbara Newborg, M.D.; Edward S. Orgain, M.D.; John B. Pfeiffer, M.D.; Richard M. Portwood, M.D. (Southwestern, 1954); Herbert O. Sieker, M.D.; Eugene A. Stead, Jr., M.D.; Malcolm P. Tyor, M.D.

## Required Courses

**MED-204C. Introduction to Clinical Medicine.** This seven-week course occurs over a period in late summer following the completion of the first year basic science curriculum. It is short but intensive and designed to provide the student with the necessary skills and knowledge basic to function in a clinical environment. The three major areas that are covered include: (1) history, physical examination, problem formulation; (2) laboratory diagnosis, and (3) radiology diagnosis. In each of these three areas, didactic materials are presented in a morning lecture format and are complemented by afternoon sessions in small groups with "hands on" experience. The course also includes a brief introduction to the topic of human sexuality.

The morning lectures, in part, concentrate on various organ systems and outline the salient historical features of normality and disease as well as the physical examination features pertinent to the organ system. Two afternoons each week, the students break up into small groups and, interacting with one instructor, interview, examine, present, and write-up patients from the wards at Duke and the VA Medical Center. During these patient oriented sessions, skills and techniques necessary for history taking, physical examination, bedside presentations, problem formulation, and write-up findings are introduced and practiced. Standardized patient instructors in the screening physical examination are also utilized.

The purpose of the laboratory diagnosis portion of the course is to teach the concepts and technical skills necessary for the use of the laboratory in evaluating and managing patients. The course consists of a series of morning lectures and afternoon laboratory sessions stressing the intelligent use of the laboratory in clinical medicine and presented in a disease-oriented format. The lectures summarize difficult topics not easily gleaned from reading the background materials or handouts. The laboratory sessions are designed to serve two purposes: to allow acquisition of the basic psychomotor laboratory skills needed routinely in clinical medicine, such as venipuncture, cell counting, performance of ECGs and microscopic examination of urine and blood; and to provide an opportunity for small instructor-led groups to discuss the basics of particular laboratory tests and the application of actual laboratory data to clinical practice.

The aim of the radiology diagnosis portion of the course is to introduce students to the radiographic appearances of common diseases that they will encounter during their clinical years. The principles rather than the details of radiographic interpretation are stressed in a series of morning lectures and afternoon laboratories sessions. In general, two lectures are devoted to each subspecialty area, e.g., chest radiology and neuroradiology, and these are usually scheduled to coincide with the corresponding lectures in physical and laboratory diagnosis. The laboratories are given to groups of fifteen to twenty students, and involve discussion of radiographs at the viewbox. The labs are generally designed to amplify and extend the content of the lecture material. The emphasis is on an informal discussion with considerable interaction between teacher and students. Most of the course material is related to the analysis of radiographs from the basic areas of radiology (chest, bone, gastrointestinal, urologic, and pediatric); with less emphasis on the more specialized areas (neuro, vascular, ultrasound, computed tomography, and nuclear medicine). Students will be expected to develop an understanding of how to analyze the common basic radiographic abnormalities that they will see during their second year clinical clerkships. The limited introduction to the more specialized areas provides information as to how the new imaging modalities should be applied in the diagnostic investigation of patients.



The human sexuality portion of the course provides a didactic introduction to the psychological and physiologic aspects of sexual response and sexual dysfunction that are commonly encountered in clinical practice. The treatment of sexual dysfunction, with emphasis on behavioral methods, along with other approaches to marital and sexual dysfunction are also discussed.

At the end of the course, the students are tested via a written and practical examination in radiology and laboratory medicine, as well as history, physical examination, and problem formulation. Individual student performance during the afternoon ward sessions also contribute significantly to the final grade. Weight: 7. *Waugh*

**MED-205C. Medicine.** The second year course in medicine provides students with the basic tools used in the practice of medicine. This is the time for students to consolidate the material learned during the first year and apply it to the study of their own patients. During an eight-week course it is not possible to cover systematically the entire body of knowledge of internal medicine; instead, students are provided a series of representative learning experiences based on the case study method. Our goals are to teach a method of approach to the patient and to provide a firm foundation for the solution of new medical problems as they are encountered in the months and years ahead. Specific expectations include the following: (1) Students will perform and record a history and physical examination on each patient they admit. The first two weeks on the rotation students will admit one patient per call night; thereafter, four patients per week. (2) Students will perform an independent history and physical examination on their patients. After the resident has completed the patient assessment, each student should present to the resident. They should then go back to the bedside to check any discrepancies in the historical or physical examination findings. (3) A complete work-up will include an analysis of the peripheral blood smear and urine sediment and sputum gram stain when appropriate. (4) Students should prepare for case presentations by reading the relevant sections in one of the standard textbooks of medicine. (5) The student's complete workup should be in the chart within twenty-four hours of admission in the format provided. (6) Students should take primary care responsibility for their patients, following their patients daily and including progress notes on the chart. Students are responsible for knowing what therapeutic interventions and/or diagnostic tests have been performed and the outcome of these maneuvers. (7) Students are encouraged to participate in all diagnostic procedures, such as lumbar punctures or thoracenteses, on their patients. Where appropriate, students will perform these procedures under the supervision of the house staff. (8) Daily work rounds with the house staff are mandatory and students are expected to participate in patient care decisions. This will necessitate students seeing patients *before* work rounds. Attending rounds cannot be missed without the prior permission of the attending physician. (9) Students are expected to present patients to attending physicians within 24 hours after admission and to know the rationale for patient work-up and all pertinent medical information. (10) Students should attend all Grand Rounds and Student Lecture Series unless ward duties preclude. Weight: 8. *Neelon*

**MED-207C. Neurology.** The second year course in neurology provides the student with a firm understanding of the neurological examination, formulation of clinical neurological problems, and practice with written and oral communications in a hospital setting. The student has the opportunity to apply the neuroanatomy, neurophysiology, neurochemistry, and neuropathology learned in the first year to the evaluation and care of his or her patients. Each student is assigned patients from the neurology services at Duke Hospital or the Durham VA Medical Center. The student elicits a history and performs a physical examination. The student records the findings in the hospital charts and presents the findings at regular staff rounds. The student then participates with a clinical team of faculty and house officers in the hospital evaluation of the patients. The student is encouraged to participate in all diagnostic procedures such as lumbar puncture. The student has the opportunity to follow patients through neuro-radiological and neuro-surgical procedures forming part of evaluation and treatment.

The specific expectations for the sophomore student are: (1) to perform and record a competent neurological and history examination on each admitted patient, (2) to be competent in the hospital management of neurological patients including diagnostic appropriate electrical studies, (3) to assume responsibility as the primary care person for his or her patients, to include daily progress notes on hospital charts, and to be familiar with the results of all therapeutic interventions and diagnostic tests performed on his patients, (4) to participate in daily work rounds with an assigned team of house officers and faculty, (5) to be sufficiently knowledgeable to be able to participate in patient care decisions, (6) to attend faculty attending rounds and to present his patients to faculty within twenty-four hours after admission, and (7) to participate in neurology service rounds and conferences during the course.

The course includes faculty lectures. A written evaluation is provided to the students by faculty and house staff. There is an examination.

This course is usually taken in conjunction with CFM-207. Weight: 4. *Morganlander*

## **Electives**

**MED-210C. Advanced General Medicine (Duke/Durham-VA).** (1) Course Goals: To expand the experience and knowledge gained during the second year medicine clerkship. Primary—Providing additional experience in the management of hospitalized patients with a wide variety of general internal medical problems. Secondary—Developing a comprehensive understanding of the pathophysiology of the common problems encountered on an internal medicine inpatient service. This course is recommended for students who receive a straight grade of Pass in MED 205C. (2) How Goals Will Be Achieved: Students will be assigned to one of the general medical wards at either Duke or the VA Hospital. They will be assigned patients in rotation with the second year students on the service and will be expected to perform and complete an initial evaluation, develop a care plan, write the orders (to be countersigned by the intern), present the patient at teaching rounds, and follow the patient throughout the hospital course. Students will be assigned three to five patients per week and will be expected to do outside reading on each. The student may be advanced to the subinternship level during the eight week period at the recommendation of the chief medical resident. (3) Methods of Evaluation: The evaluation form will be made available to each student at the beginning of the rotation. There will be formal mid-term and final evaluations. No final exam is given. Requests for Duke or Durham VA rotation will be accepted on first come, first served basis. Call 286-6447. Weight: 10 Max: 6. *Greenfield and staff*

**MED-211C. Internal Medicine Subinternship (Duke/Durham-VA).** (1) Course Goals: To provide an internal medicine patient care experience at the intern level. (2) How Goals Will Be Achieved: Students will be assigned to one of the two inpatient services at either Duke or VA and will be supervised by a second or third year internal medicine resident. The student will function as an intern on that service with the exception that orders must be countersigned by a medical house officer. A pager and sleep-in facilities will be available. No other medical intern will be assigned to those patients handled by the subintern. The number of patients assigned will be determined by the supervising resident with anticipated increases during the course. (3) Methods of Evaluation: Students will be evaluated by their resident and senior staff attending. The evaluation form will be made available to each student at the beginning of the rotation. There will be an informal evaluation at two weeks and a formal evaluation at four weeks. No final exam is given. Prerequisites: available only to Duke medical students who receive grades of Honors or P+ in MED 205C. Requests for Duke or Durham VA will be accepted on first come, first served basis. Call 286-6447. Weight: 5 or 10 Max: 13. *Greenfield and staff*

**MED-213C. Tutorial in Medical PDC.** (1) Course Goals: Primary—To broaden student exposure to ambulatory care in internal medicine and understanding of outpa-



tient evaluation. Secondary To develop the student's doctoring skills by focusing on the physician/patient interaction. (2) How Goals Will Be Achieved: Students will work in a one-to-one relationship with a faculty member in the Department of Medicine who see patients regularly in the Medical PDC. Students will complete the initial work-up of patients and develop plans for treatment and follow-up care in consultation with the preceptor. They may follow patients admitted to the hospital. Students may choose to spend time in the acute care clinic as well as seeing scheduled patients with a selected attending physician. The patients may be general medical patients or patients within their attending's subspecialty. (3) Methods of Evaluation: The preceptor will observe the student's interaction with patients and the quality of the work-ups including follow-up, care plans, and their implementation. Prerequisites: Students must prearrange their elective with an individual preceptor and communicate the preceptor's approval to Dr. Neelon (684-4307). Weight: 2 (10 hrs/wk for 8 weeks), 4 (20 hrs/wk for 8 weeks or 10 hrs/wk for 16 weeks), or 8 (full time for 8 weeks). *Neelon and staff*

**MED-214C. Rural Health Elective.** Through a seminar series and experiences working in a community-sponsored rural health clinic, students will begin to understand the forces that impact health and health care in rural North Carolina. The seminar series includes speakers and discussion on such topics as the economics of health care, health education, worker health, environmental health, cultural and ethical bias in health care and community action for health care workers. Students organize volunteer staffing for the Fremont clinic, and orient and teach other students. Students should have volunteered for the North Carolina Student Rural Health Coalition in either year one or year two. The grade for this year-long course will be posted at the end of the second term. One credit per term will be awarded. C-L: CFM 214C. Weight: 2 Min: 1 Max: 10. *B. Sheline*

**MED-216C. Summer Elective in Primary Care General Internal Medicine.** Primarily designed for fourth year students with interests in primary care general internal medicine and with special interest for under-represented minority students and students from disadvantaged backgrounds. This four week course is presented Monday thru Friday and therefore meets the sole-enrollment criteria. During the course, the students will be involved in a variety of outpatient clinic settings in general internal medicine at Duke and in the community. The student will also participate with primary care internal medicine residents in an extensive series of small group didactic sessions covering the broad range of topics critical to the knowledge base of a primary care internist. A student designed project will be initiated, completed, and presented informally at the conclusion of the elective. Student in the Primary Care Medical School Track are encouraged to apply. Completion of an application and approval of the instructor is required for matriculation. Weight: 4 Max: 2-4. *Wong*

**MED-220C. Emergency Room.** (1) Course Goals: Primary-To provide a broad exposure in the Emergency Room to clinical problems, emphasizing acute internal medicine in such a way that students can see patients before any other physician contact permitting the learner to make diagnoses and plan short-term "workups". Secondary-To develop students' ability to rapidly obtain history and shorten the amount of time required to do accurate physical examination, to enhance students' dexterity when performing minimally invasive procedures, and to teach the concepts of triage and prehospital care. (2) How Goals Will Be Achieved: Each student works with attending physicians and nine different residents (*not* interns). Each student will work approximately 18 to 20 twelve hour shifts and in general will not spend the night. In collaboration with residents or senior staff, students will be involved in diagnostic procedures and interpretation of studies before planning management of illness with some opportunities to supervise subsequent care for up to twenty-four hours. Thus, students can test their ability to make diagnoses and plan acute studies. Didactic sessions, held twice weekly, cover clinical topics related to emergency medicine and complement a daily



morning report. Working with nurses at triage station permits view of a function rarely seen by learners of medicine. Every student is encouraged to ride in the ambulance with Durham County's paramedics. Students electing an eight week rotation double their experience in subacute internal medicine as described above, but also may elect to work on the acute side of the ER caring for patients who have myocardial infarction, life threatening arrhythmias, medical coma, pulmonary edema, status epilepticus, severe GI bleeding, and drug overdose. (3) Methods of Evaluation: Residents and senior staff evaluate the student's gain in rapidity of doing history/physical examinations, increased dexterity in performance of minimally invasive procedures, and increase in knowledge and skill to interpret/present data to others. Prerequisites: none mandatory, prior experience in other electives will be beneficial. Weight: 4 or 8 Min: 1 Max: 4. *Wellman*

**MED-223C. Intensive Care Medicine Subinternship (Duke).** (1) Course Goals: Primary – To introduce the student to a pathophysiologic approach to critically ill adults. Secondary – To provide an opportunity for students to perform selected procedures. (2) How Goals Will Be Achieved: Students will function as subinterns in a very active intensive care unit. Patient evaluations, procedures, diagnostic planning and treatment planning are performed by students under the direct supervision of the junior assistant resident, critical care fellow, and attending physician. Night call occurs every third night. Regular didactic lectures on topics related to the diagnosis and treatment of the critically ill will be given by the attending staff. The physiological and biochemical approach to critical care medicine is stressed. A syllabus of selected reprints from the critical care literature is provided to each student. Emphasis is placed on access to attending physicians and pulmonary fellows for the discussion of specific patient oriented questions. Preferences for the month of rotation will be honored if possible. Questions should be directed to Dr. Fulkerson, 681-5850. (3) Methods of Evaluation: Each student's performance is assessed by the unit director through direct observation of the student in the clinical and didactic environments. Input from the residents, fellows, and other attending physicians is also obtained. Weight: 5 Max: 3. *Fulkerson and pulmonary staff*

**MED-224C. Intensive Care Medicine Subinternship (Durham-VA Hospital).** (1) Course Goals: Primary–To provide training in clinical physiologic and pharmacologic principles of the care of the critically ill. Secondary–To develop students' skills in performance and interpretation of diagnostic procedures. (2) How Goals Will Be Achieved: Under the supervision of junior assistant residents and a pulmonary fellow, students will function as subinterns and will be responsible for patient workups and daily bedside presentations. Students are given responsibilities for procedures and decision-making in direct proportion to the development of their patient management skills. Daily attending rounds stress an integrated physiologic approach to the management of critically ill patients with emphasis on acute respiratory care, hemodynamic monitoring, acid-base balance, and nutritional support. Each student is provided with a syllabus of selected readings that supplements regular didactic sessions on diagnosis, pathophysiology, and management of critical illness. Student on call schedule is every third night for the duration of this four-week course. Students may obtain information by telephoning 286-6946 or 684-6143 and should arrange for a replacement if they subsequently drop the course. (3) Methods of Evaluation: Student evaluations are done by the fellows and faculty attending on the MICU and are based on observed performance. Weight: 5 Max: 3. *Piantadosi and pulmonary staff*

**MED-230C. Pulmonary Medicine.** (1) Course Goals: Primary–To provide training in clinical aspects of pulmonary medicine. The primary diseases emphasized include asthma, chronic obstructive lung disease, pulmonary vascular diseases including pulmonary embolus, acute respiratory failure, hypersensitivity, interstitial and immunologic lung diseases and pulmonary manifestations of systemic illnesses, i.e., sarcoid, scleroderma, cystic fibrosis, etc. Secondary–To provide experience with pulmonary laboratory techniques including pulmonary function testing, cardio-pulmonary exercise

testing, chest radiology, and bronchoscopy. (2) How Goals Will Be Achieved: Students will be assigned to the Pulmonary Consult Services at either the VA or at Duke Hospital. They will have primary responsibility for workup and presentation of selected patients on these services. All patients are presented and followed at daily rounds with fellows and faculty. Students will also participate in a half-day outpatient clinic each week. Joint seminars and conferences involving both the Duke and VA Consult Services are held each week to provide instruction in pulmonary function evaluation, pulmonary physiology, chest radiology, pulmonary pathology and clinical pulmonary medicine. (3) Methods of Evaluation: Student evaluations are done by fellows and faculty assigned to the Consult Services during the period of the course and are based on observed performance. Weight: 4. Min: 1 Max: 4. *Crapo and pulmonary staff*

**MED-231C. Allergy-Immunology.** (1) Course Goals: Primary-Precepted instruction in the critical use of medical laboratory information. Secondary-Familiarization of the student with the clinical uses of the Allergy-Immunology laboratory. (2) How Goals Will Be Achieved: The consultative role of the Allergy-Immunology laboratory is used to focus critical awareness on the clinical utility and pitfalls of laboratory studies. During the first two weeks, the student will clinically evaluate selected patients with altered immunity (impaired resistance to infection, hypersensitivity, autoimmunity, neoplasia or other immunologic problems) from the clinic and/or consultative service. This experience is used to identify an acceptable topic for selected readings and discussions focused on either laboratory procedures or an immune alteration associated with a disease. These readings and discussions provide the basis for a required short (ten to twenty double-spaced, typed pages excluding references), critical technical report on the utility of either a specific laboratory procedure or the value of laboratory studies in the care of patients with a specific immune disease. (3) Methods of Evaluation: The depth of the student's understanding of the problem, ability to use the information reviewed, and the content of the technical report are used to evaluate student performance. Prerequisites: permission of instructor. Weight: 8. Max: 1. *Buckley*

**MED-242C. Clinical Arrhythmia Service.** (1) Course Goals: Primary-To provide students with an in-depth exposure to the diagnosis and management of cardiac arrhythmias, electrophysiologic studies, ablation of arrhythmias, cardiac pacemakers, and implantable defibrillators; to help students to understand the electrophysiologic events that result in arrhythmias and ECG changes. This course is not designed to be a substitute for the general cardiology elective (MED 240C). Secondary-To familiarize the student with certain basic techniques of arrhythmia diagnosis such as esophageal recording and pacing. (2) How Goals Will Be Achieved: The student will spend four weeks working on the Clinical Arrhythmia Service. The student will make rounds with the Clinical Electrophysiology Service on inpatients with arrhythmia problems. The student is encouraged to attend electrophysiologic studies and assist in the analysis of data from these studies. Attendance of electrophysiologic surgical procedures is also encouraged. The student will be responsible for the work-up of patients admitted to the Arrhythmia Service as well as inpatient consults and will play an important role in the follow up of these patients while they are in the hospital. The student will see outpatients during Arrhythmia Clinic that meets Wednesday afternoons in the PDC. The student will assist in the evaluation of patients for permanent pacemaker implantations. Students will be responsible for reviewing the literature on subjects related to the patients that they have seen on the clinical service. (3) Methods of Evaluation: Students will be evaluated on their clinical skills in taking histories, performing physical examinations as well as in their presentation and assessment of the patient's problem. They will also be assessed on their ability to read and understand the relevant literature and their ability to assume a responsible role in the care of patients on the Clinical Arrhythmia Service. Weight: 4. Max: 1. *Wharton, Pritchett, Grant, Greenfield, Sorrentino, and Merrill*



**MED-243C. Cardiology Subinternship (Asheville VA).** (1) Course Goals: Primary--To provide experience in the assessment and management of patients with acquired heart disease. Secondary - To familiarize the student with both invasive and non-invasive procedures available at this medical center. (2) How Goals Will Be Achieved: The student will be assigned to an attending cardiologist and will be expected to work up patients presenting to both the coronary care unit and the cardiology nonacute ward. Daily work rounds will commence at 7:30 a.m. with additional student teaching rounds occurring three times a week. In addition, daily interpretation of electrocardiograms, stress tests, Holter monitors, and echocardiograms will focus on student teaching. Cardiac catheterization results will also be reviewed on a daily basis. Night call will be optional, but students may elect to take call with appropriate attendings. (3) Methods of Evaluation: The preceptor will evaluate the student's ability to assess patient problems based on the history and physical and to formulate a plan to evaluate the problems. Furthermore, the preceptor will assess each student's ability to evaluate and act upon data derived from both invasive and non-invasive diagnostic methods. Weight: 4 Max: 2. *Patel, Ahmad, and Shirzai*

**MED-244C. In-Patient Cardiology.** (1) Course Goals: Primary--To provide an in-depth experience in the evaluation and care of in-patients with various cardiovascular problems requiring hospitalization. Secondary--To refine student understanding of the cardiovascular history, physical examination and non-invasive and invasive laboratory testing in evaluating and managing patients with known or suspected cardiovascular disease. (2) How Goals Will Be Achieved: Students will be assigned to the Duke CCU, the VA CCU, or to the private cardiology in-patient service at Duke. They will work in concert with the housestaff, cardiology fellows, and senior staff attendings in working up and managing patients admitted to these various services. They will also participate in a core curriculum experience, including individually assigned times to work with the cardiology patient simulator and various computer assisted instruction programs. Because of the considerable logistics involved in scheduling and coordinating the various cardiology electives, students who wish to drop must do so at least one week before the scheduled starting date. After that time, drops will be allowed only if a replacement student can be provided. (3) Methods of Evaluation: Students will be evaluated by all resident, fellow, and senior staff with whom they work. The evaluation questionnaire will be made available at the beginning of the elective. Depending on circumstances, students may also be evaluated by written and practical examinations at the beginning and/or end of the elective. Weight: 5. Min: 1 Max: 6. *Wagh*

**MED-245C. Consultative Cardiology.** (1) Course Goals: To refine student understanding of normal and pathologic cardiovascular physiology while functioning in the role of a consultant for in-patients with various cardiovascular problems; to develop the skills necessary to quickly and accurately interpret ECGs. (2) How Goals Will Be Achieved: Students will be assigned to the consult service at either the VA Hospital, Duke, or, as availability/interest permits, the Electrophysiology Service at Duke where, in concert with the SAR, fellow and senior staff attending, they will evaluate the operative risk for non-cardiac surgery as well as make decisions concerning cardiac surgery in patients with ischemic and other types of heart disease. Students will also participate extensively in reading ECGs. They will also participate in a core curriculum experience including individually assigned times to work with the cardiology patient simulator and various computer assisted instruction programs. Because of the considerable logistics involved in scheduling and coordinating the various cardiology electives, students who wish to drop must do so at least one week before the scheduled starting date. After that time, drops will be allowed only if a replacement student can be provided. (3) Methods of Evaluation: Students will be evaluated by the resident, fellow, and senior staff with whom they work. The evaluation questionnaire will be made available at the beginning of the elective. Depending on circumstances, students



may also be evaluated by written and practical examinations at the beginning and/or end of the elective. Weight: 4. Min: 1 Max: 7. *Waugh and cardiology staff*

**MED-250C. Clinical Dermatology.** Course Goals: To train students to notice and recognize both crucial and trivial dermatological physical findings so that they may be able in the future to: (1) describe physical findings in the skin accurately; (2) formulate a reasonable differential diagnosis based on what is seen; (3) know when biopsy or referral is indicated; (4) prescribe appropriate therapy; and (5) recognize important dermatologic findings related to significant health problems. Students on the rotation will spend two weeks in the Duke clinics and two weeks at the V.A. Hospital. While at Duke, students will rotate through private dermatology clinics, public dermatology clinics, dermatologic surgery clinics, and various sub-specialty clinics. At the V.A., there will be two major outpatient clinics each week supplemented by daily acute care clinic/screening-clinic/ER walk-in consultations. Students will also participate in the inpatient consult services and will assist in the supervision of inpatient dermatology patients. There is no night or weekend call on the rotation. The clinic experiences are supplemented with lectures and teaching conferences. Interesting cases from the V.A. experience are presented weekly at a Thursday morning conference. The majority of the teaching is one-on-one. Student evaluations are based on development of clinical skills as assessed by faculty and residents, presentations at weekly conferences, and a written and Kodachrome objective examination given at the end of the course. Any special needs can be discussed with the course director who may be reached at 684-5146. Students are to report to the Dermatology Clinic, Room 0027, Orange Zone at 0830 the first day of the rotation for further orientation and clinic assignment. Weight: 4. Max: 4. *Prose*

**MED-251C. Lectures And Demonstration in Clinical Dermatology.** (1) Course Goals: To familiarize students with the pathophysiology, clinical presentation, and treatment of dermatological disorders. (2) How Goals Will Be Achieved: The course will be presented over an eight week period with two lectures weekly by our dermatology faculty using 35mm Kodachromes. Clinical correlation will be graphically illustrated by student attendance of the bimonthly Duke/UNC Dermatology conferences held alternately at Duke and UNC. At these conferences, five to eight patients with unusual dermatological diseases or management questions are presented and discussed by the faculty and residents of both university dermatology departments and approximately twenty dermatologists from the surrounding area. (3) Methods Of Evaluation: Course will be pass/fail dependent upon attendance of lectures and conferences. Those wishing to apply for honors must contact the course director at the onset of elective and choose a pertinent topic in dermatology to be reviewed and presented orally to the group at completion of the rotation. If permitted by instructor, this course can be audited. Weight: 2. Min: 15. *Olsen and dermatology staff*

**MED-260C. Gastroenterology.** (1) Course Goals: Primary – To provide an experience with digestive diseases from which the student can develop a sound fundamental approach to the diagnosis and management of these problems. Secondary – To provide an exposure to recent advances in the field including therapeutic and diagnostic endoscopy; to stimulate questions concerning digestive diseases and to attract students into the field. (2) How Goals Will Be Achieved: Participation in the care, work-up and management of patients hospitalized on the general wards of Duke or the VA Hospital under the guidance of the resident, fellow, and faculty members assigned either to the VA or Duke Consultation Service. The students' experience may include participation in the activities of the new clinic endoscopy unit of the Division of Gastroenterology. This unit offers specialized tests and/or procedures necessary for the state of the art care of patients with digestive diseases. Procedural activities include upper endoscopy, endoscopic retrograde cholangiopancreatography, colonoscopy and polypectomy and endoscopic papillotomy of the ampulla of Vater. Data derived from these and other laboratory studies are discussed in the context of specific patient problems in weekly

conference settings. Students have an opportunity to interact with all the faculty of the division at morning rounds and other conferences where patients from all of the services (Duke and VA) are discussed. (3) Methods of Evaluation: Student evaluation forms are completed by the resident, fellows, and faculty working with the student on individual patient care services. Final evaluation represents a composite of these forms that chiefly identifies clinical skills, fund of basic information, organizational ability, and degree of interest and participation. Weight: 4. Max: 5. *Liddle and gastroenterology staff*

**MED-270C. Outpatient Hematology-Oncology (Duke or Durham VA).** (1) Course Goals: To give the student experience in the diagnosis, long-term treatment, and supportive care of patients with hematologic and oncologic disorders in the outpatient setting. The use and interpretation of peripheral blood films and other specialized laboratory tests (e.g., bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), as well as an approach to the evaluation and treatment of common hematologic problems (anemias, bleeding and clotting disorders, hematologic and solid tissue malignancies) will be included. Issues such as quality of life and care of the geriatric oncology patient will be addresses. (2) How Goals Will Be Achieved: The student will be assigned a staff member as preceptor with whom to work in the Hematology/Oncology clinic one half day per week. If desired, a preceptor who concentrates mainly on hematology or oncology may be arranged. This course is offered for eight or, preferably, sixteen weeks. (3) Methods of Evaluation: Students will be evaluated by their preceptors on the basis of their ability to obtain a history, perform a physical examination, evaluate hematologic and other laboratory data, and propose assessments and plans of action. Weight: 1-2. Max: 4. *Kaufman and hematology/oncology staff*

**MED-272C. Clinical Hematology and Oncology (Duke or Durham VA).** (1) Course Goals: Students will learn how to interpret peripheral blood films, how to use and interpret other specialized laboratory tests (e.g., bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), and how to approach the evaluation and treatment of common hematologic problems (anemias, bleeding and clotting disorders, hematologic and solid tissue malignancies). (2) How Goals Will Be Achieved: Students will receive a series of core lectures, gain familiarity with chemotherapy regimens and administration, and attend the ongoing clinical, research, and didactic divisional conferences. Clinical duties will be the performance of inpatient consults under the supervision of a fellow and staff member. Students may opt to pursue a broad experience in hematologic and oncologic problems or may choose to focus on a particular area, e.g., coagulation and transfusion, experimental therapeutics of malignancy, bone marrow transplant, hemoglobinopathies. Students choosing the broad experience may elect to spend one week on the coagulation/transfusion consult service. This course may be taken for four or eight weeks. (3) Methods of Evaluation: The student will be expected to perform and present initial evaluations of consult cases including peripheral blood film on daily rounds, and to perform limited literature searches and evaluations of chosen clinical topics. Weight: 4 or 8. Max: 4. *Kaufman and hematology/oncology staff*

**MED-274C. Medical Subinternship in Hematology-Oncology.** (1) Course Goals: This is an intensive experience in the care of inpatients with serious hematologic and oncologic disorders. The student will learn to interpret peripheral blood films, how to use and interpret other specialized laboratory tests (e.g., bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), and how to approach the evaluation and treatment of hematologic and solid tissue malignancies and their complications. (2) How Goals Will Achieved: Under supervision of a Hematology/Oncology fellow and a division staff member, the student will be given considerable responsibility in the care of inpatients on one of the Hematology/Oncology or Experimental Therapeutics wards in Duke North. They will receive instruction and



guidance in performing diagnostic and therapeutic procedures and gain experience in the use of chemotherapeutic drug regimens. Specific issues such as quality of life, care of the aging patient with malignancy, and decisions regarding DNR status will be addressed by the patient-care team. In addition, students will receive a series of core lectures, receive training in chemotherapy, and attend the ongoing clinical, research and didactic divisional conferences. (3) Methods of Evaluation: Students will be evaluated by their preceptors on the basis of their ability to obtain a history, perform a physical examination, evaluate hematologic and other laboratory data, and propose assessments and plans of action. Prerequisite: Approval of the faculty based on prior performance. Weight: 5. Max: 4. *Kaufman and hematology/oncology staff*

**MED-275C. Clinical Coagulation.** (1) Course Goals: Primary–To teach the clinical and laboratory approach to patients with a hemorrhagic or thrombotic disorder. The student will learn to evaluate clinical coagulation disorders and become familiar with coagulation laboratory testing and interpretation. Secondary–To expose the student to recent advances in the area of coagulation research. (2) How Goals Will Be Achieved: The student will spend four weeks on the Clinical Coagulation Consult Service under the direction of Dr. B. Gail Macik, Dr. Charles Greenberg, Dr. William Kane, Dr. Thomas Ortel, Dr. Manuel Santiago, or Dr. Scott Berkowitz. The student will be expected to work-up inpatients referred to the Coagulation Service as well as participate in a half day a week Coagulation Outpatient Clinic. The rotation includes coagulation lab rounds during which the student will learn to interpret lab tests and review abnormal results. The student will be expected to present patients at the weekly clinical coagulation conference and to briefly discuss the evaluation and management of the patient supported by a limited literature review. Students electing to do an eight week rotation will have a more extensive laboratory and clinical research experience. (3) Methods of Evaluation: The student's performance will be evaluated by the coagulation attending with input from the fellow on the service. The evaluation will be based on observation of the student's ability to do careful histories and physical examinations, to appropriately assess the problem and develop a logical diagnostic and therapeutic plan, and to demonstrate an increase in knowledge regarding laboratory tests and their application to clinical problems. Weight: 4 or 8. Max: 2. Macik, Greenberg, Kane, Ortez, Santiago, and Berkowitz

**MED-280C. Clinical Infectious Diseases.** (1) Course Goals: To provide experience in the clinical and laboratory diagnosis of infectious diseases and in their therapy. The primary emphasis will be placed on learning from interaction with patients, resident staff, and faculty on the consultation service. Students are expected to work up assigned patients by interview, physical examination, and collation of laboratory results, leading to a summary and synthesis of the problem. Particular emphasis will be placed on close follow-up of the patients during hospitalization, including attendance at procedures or operations whenever possible. Students should know their own patients well enough to be able to give a reasonable presentation on ward rounds or at conferences without notice. Students will be expected to read standard texts in-depth about their patients' problems, as well as a few recent relevant primary references. Students are expected to attend the various conferences listed on the weekly schedule of division activities punctually including Microbiology Plate Rounds, Journal Club, and tutorials. They will be asked to present cases and provide some discussion at the Thursday V.A. Conference. Each student should be prepared to present and briefly discuss articles that he or she considers to be interesting and timely at Journal Club. (2) Methods of Evaluation: Each student's performance will be evaluated and graded by the resident, fellow, and attendings, using the usual "honors," "pass plus," "pass," "deferred," or "unsatisfactory" system that is utilized internally in the Department of Medicine. In arriving at a consensus, appropriate emphasis will be placed on knowledge, enthusiasm, and evidence of improvement during the rotation. There will be no written examination. Adds will be



accepted at any time providing the course has not been filled. However, because this course is usually oversubscribed, drops will not be accepted within thirty days of the first day of classes unless the student finds his own replacement. MED 280C is a full-time experience. Also, it is offered as a sole-enrollment course and, as such, cannot be taken in conjunction with any other course without the permission of the advisory dean and the course director. Weight: 4 Max: 5. *Durack and infectious diseases staff*

**MED-290C. Metabolism and Endocrinology.** (1) Course Goals: Primary–The student will have an in-depth experience in the evaluation and management of patients with endocrine disorders. Secondary– The student will learn basic principles of hormone physiology and apply these concepts in clinical settings. (2) How Goals Will Be Achieved: Each student will be introduced to patient problems by working with the endocrine faculty (Drs. Brown, Burch, Clark, Domalik, Drezner, Econs, Ellis, Feinglos, Guyton, Harper, Johnson, or McNeill.) Prior arrangements may be made with a particular faculty member under the appropriate course number. Students will be exposed to clinical endocrine disorders by seeing patients in four endocrine outpatient clinics (bone and mineral, diabetes, general endocrine, and VA General Endocrine Clinic), as well as dividing their inpatient experience between the Diabetes Management/Lipid Consult Service and General Endocrine Consult Service. The student will have the opportunity to review general literature on common endocrinologic conditions and endocrinologic emergencies as well as learning basic assessment skills of the patient with diabetes, thyroid disease, and other common endocrinologic presentations. Division conferences include Grand Rounds, Research Seminar, Inpatient Attending Rounds, and Consult Rounds with opportunities to integrate basic concepts with clinical applications. (3) Methods of Evaluation: A written critique will be provided by the student's preceptors with comments from other members of the division as appropriate. Weight: 4. Max: 3. *McNeill and endocrinology staff*

**MED-300C. Nephrology.** (1) Course Goals: Primary – To provide clinical experience in the diagnosis, assessment and treatment of renal diseases and hypertension. Secondary – To integrate renal physiology, immunology, pathology, and biochemistry into the clinical assessment of renal diseases. (2) How Goals Will Be Achieved: Students participate fully in both inpatient and outpatient assessment of patients presenting with fluid and electrolyte disorders, problem hypertension, acute renal failure, end-stage renal disease, and related complications. The student rounds daily with a renal fellow or senior resident, attends regular faculty teaching rounds and scheduled conferences devoted to correlations with basic science review of renal biopsy material, transplantation, etc. Special emphasis is placed on renal physiology and pathophysiology, renal histopathology, and hypertension. Students may elect to participate at the VA Hospital or on the private or nonprivate services at Duke. (3) Methods of Evaluation: Written comments from the faculty. Weight: 4. Max: 4. *Raymond and nephrology staff*

**MED-301C. Fluids and Electrolytes.** (1) Course Goals: Primary–To provide an applied approach to the management of fluid and electrolyte problems encountered in clinical medicine. To do this, cases are presented as problem-solving examples. The goal is to develop a systematic approach to the analysis of specific electrolyte derangements and to the correct selection of appropriate intravenous replacement therapy. These case studies are interwoven with a series of lectures designed to review specific areas such as compartmentalization of body fluids, derangements in acid-base balance, diuretic selection and use, analysis and approach to the treatment of potassium problems, etc. Secondary–To integrate basic renal physiology with clinical problems of fluid and electrolytes metabolism. (2) How Goals Will Be Achieved: Classroom experience. Does not involve patient exposure. (3) Methods of Evaluation: Final exam. If permitted by the instructor, this clinical science course can be audited. Weight: 2. Min: 6. *Yarger and nephrology staff*

**MED-307C. Neurology Clerkship.** This course is restricted to those students who did not take the Neurology rotation in their second year. It provides the student with a firm understanding of the neurological examination, formulation of clinical neurological problems, and practice with written and oral communications in a hospital setting. The student has the opportunity to apply the neuroanatomy, neurophysiology, neurochemistry, and neuropathology learned in the first year to the evaluation and care of his or her patients. The patients are drawn from the neurology services at Duke Hospital or the Durham VA Medical Center. The students elicit a history and perform a physical examination. The student records the findings in the hospital charts and presents the findings at regular staff rounds. The student then participates with a clinical team of faculty and house officers in the hospital evaluation of the patients. The student is encouraged to participate in all diagnostic procedures such as lumbar puncture. The student has the opportunity to follow patients through neuro-radiological and neuro-surgical procedures forming part of evaluation and treatment. The specific expectations for the student are: a) to perform and record a competent neurological and history examination on each admitted patient; b) to be competent in the hospital management of neurological patients including diagnostic evaluations such as hematological and urine evaluations, lumbar puncture and appropriate electrical studies; c) to assume responsibility as the primary care person for his or her patients; d) to participate in daily work rounds with an assigned team of house officers and faculty; e) to be sufficiently knowledgeable to participate in patient care decisions; f) to attend faculty attending rounds and to present his patients to faculty within twenty-four hours after admission; and g) to participate in neurology service rounds and conferences during the course. The course includes faculty lectures. A written evaluation is provided to the students by faculty and house staff. There is an examination. Weight: 4. Max: 1. *Morgenlander and neurology staff*

**MED-308C. Clinical Neurology Subspecialties.** (1) Course Goals: To provide the student to clinical exposure to a specific subspecialty in neurology. (2) How Goals Will Be Achieved: The student will focus on one specific subspecialty in neurology and will attend clinic for two to six hours weekly. During that time the student will participate in the clinical evaluation of patients with a member of the neurology faculty. Clinical experience in neuromuscular diseases, epilepsy and sleep disorders, memory disorders, or neuro-oncology are available. Appropriate reading material will be utilized to complement the clinical experience. MED 207C or MED 307C are prerequisites for this course. (3) Method Of Evaluation: Standard written evaluation form by faculty supervisor. Approval by the course director in order to ensure access to the desired neurologic subspecialty is required. Weight: 1-2. Max: 5 (if participating in different subspecialties) *Morgenlander and neurology staff*

**MED-309C. Consultative Neurology.** (1) Course Goals: To introduce senior medical students to the diagnostic and treatment issues encountered on the consultative neurology service. (2) How Goals Will Be Achieved: The student will become part of the inpatient neurology consultation team either at Duke Hospital or the Durham VA Hospital. This team will consist of senior neurology attendings on a rotating basis as well as a neurology and/or medicine house officer. Consultations will be performed by the student under the guidance of the house staff and then will be presented to the attending on rounds. The student will be responsible for performing a neurologic history and physical as well as assisting in the interpretation of all important laboratory data. The student will continue to follow the patient's course as required. The student will also attend rounds when other patients are presented by the house officers. Appropriate reading material will be utilized to compliment the clinical experience. Attendance at Neurology Grand Rounds and various Neurologic Subspecialty Conferences will be required. Experience on an inpatient neurology service such as MED 207C or MED 307C are prerequisites for this course. (3) Method of Evaluation: Standard written evaluation



by faculty supervisor with house staff input. Weight: 4. Max: 2. *Morgenlander and neurology staff*

**MED-310C. Neurology Subinternship.** (1) Course Goals: To provide a neurological patient care experience at the intern level. Students will have the opportunity to apply neurological examination skills learned in the second year to direct patient care situations. Students will be exposed to a variety of neurological problems, procedures, and therapies. This course is recommended for the student interested in neurology, psychiatry, internal medicine, neurosurgery, neuropathology or ophthalmology. (2) How Goals Will Be Achieved: Students are assigned to the Duke or Durham VA Hospitals' neurology ward and take call in rotation with a medical intern as part of a patient care team. Students attend Neurology-Neurosurgery Grand Rounds, Medicine Grand Rounds, Neuropathology Conferences and participate in all ward activities. Full time participation is expected. (3) Methods of Evaluation: Resident and staff physician provide a written evaluation and grade. Weight: 5. Min: 1 Max: 1. *Morgenlander and neurology staff*

**MED-320C. Rheumatic and Immunological Diseases.** (1) Course Goals: Primary – To provide the student with experience in the recognition and care of patients with rheumatic, inflammatory disease and immunological disease with particular attention to the various forms of arthritis, connective tissue disease, vasculitis and metabolic arthropathies. Secondary – To have the student achieve exposure to interpretation of the specialized laboratory and clinical techniques relating to evaluation of patients with rheumatic, immunological, and metabolic disorders. Joint aspiration and injection, synovial fluid analysis, bone and joint radiology, histopathological analysis of tissue biopsy and interpretation of related serological testing will also be studied. (2) How Goals Will Be Achieved: Students will evaluate patients at the Duke and Durham VA Hospitals. Daily rounds will be held with faculty and house officers with emphasis on presentation of patients with detailed review of associated laboratory, x-ray and pathological findings. Basic Science Conference, Bone and Joint Radiology Conferences, Pathology Conference and Rheumatology/Immunology Grand Rounds are held at regular weekly intervals. A comprehensive approach to the evaluation and treatment of patients with rheumatic, inflammatory, immune and metabolic disorders is emphasized. Patients are assigned primary house officer level responsibilities on the Consultation Service at the Duke or Durham VA Hospitals. In addition to consult and inpatient responsibilities, students will be assigned to ambulatory care clinics at both hospitals and participate in all scheduled functions of the Division. (3) Methods of Evaluation: Student evaluations are based on patient presentations, participation and discussions on rounds and in conferences, and their functions in the outpatient clinics. This is a sole-enrollment course and, as such, cannot be taken in conjunction with any other course. Weight: 4 Max: 4. *McCallum and rheumatology/immunology staff*

**MED-321C. Introduction to Clinical Rheumatology.** (1) Course Goals: An introductory course in Clinical Rheumatology designed to introduce students to the basics of differential diagnosis in the field of rheumatic disease; to provide more detailed knowledge of the most common, major groups of rheumatic disorders. (2) How Goals Will Be Achieved: Didactic and interactive lectures will be the primary mode of teaching. Handouts and outlines on relevant topics and the *Primer of Rheumatic Diseases* will be provided at the beginning of the course. One or more sessions(s) will be devoted to patient presentations, with several patients available for questioning and discussion. Basic pathophysiology, clinical features, laboratory studies, radiographic findings and pathology correlations will be presented. (3) Methods of Evaluation: Participation in class and discussion of subject matter in concluding session. Course director will evaluate student with standard Duke evaluation. Weight: 1 Min: 3 Max: 20. *N. Allen and rheumatology staff*



**MED-400C. Geriatric Medicine.** (1) Course Goals: Primary—To enable the student to become familiar with the principles of caring for the geriatric patient. Secondary To familiarize the student with the physiology and diseases of aging. (2) How Goals Will Be Achieved: This elective is offered by the interdepartmental faculty of the Division of Geriatric Medicine. The student will work with faculty, fellows, and housestaff in a number of settings involved in the care of the geriatric patient. These will include the Geriatric Evaluation and Treatment Clinic (Duke), Geriatric Evaluation Unit and Clinic (VA), Geriatric Consultation Services (VA, Duke), extended care and rehabilitation center (VA) and other nursing home facilities, interactions with community services, home assessment and other. Principles to be stressed will be biology and pathophysiology of aging, multiple clinical problems in the elderly, interdisciplinary team approach to evaluation, planning and treatment, goals of maximal functional achievement and independence for the elderly. The student will participate actively in the workup and management of patients in inpatient extended care and outpatient settings as well as become more familiar with the problems of the elderly in the community. Familiarity with the growing literature in geriatric medicine will be encouraged and the student will participate in seminars, lectures and team meetings at the appropriate sites including the Duke Center for the Study of Aging. (3) Methods of Evaluation: Evaluation will be by consensus of instructors and fellows at the various training sites. It will be based on discussions and presentations throughout the course period. Prerequisites: approval of course director. Weight: 4.s Max: 2. *Cohen and staff*

## COURSES CURRENTLY UNSCHEDULED

**MED 232C. Pulmonary Medicine Subinternship (Asheville VA)**

**MED 276C. Oncology Subinternship (Asheville VA)**

**MED 293C. Diabetes Mellitus Subinternship (Asheville VA)**

## Microbiology

Professor Jack D. Keene, Ph.D. (Washington, 1974), *Interim Chairman*.

Professors: Deepak Bastia, Ph.D. (Chicago, 1971); Dani P. Bolognesi, Ph.D. (Duke, 1967); David T. Durack, D.Phil. (Oxford, 1973); Sharyn A. Endow, Ph.D. (Yale, 1975); Eli Gilboa, Ph.D. (Weizman Inst. Science, 1977); Joseph R. Nevins, Ph.D. (Duke, 1976); Catherine M. Wilfert, M.D. (Harvard, 1962).

Adjunct Professors: James J. Burchall, Ph.D. (Illinois, 1963); Norman F. Weatherly, Ph.D. (Kansas, 1962).

Associate Professors: Bryan R. Cullen, Ph.D. (New Jersey, 1984); John D. Hamilton, M.D. (Colorado, 1964); Gale B. Hill, Ph.D. (Duke, 1966); Dolph Klein, Ph.D. (Rutgers, 1961); Kenneth N. Kreuzer, Ph.D. (Chicago, 1978); Elwood A. Linney, Ph.D. (California at San Diego, 1973); Thomas G. Mitchell, Ph.D. (Tulane, 1971); Stephen W. White, D. Phil. (Oxford, 1978); Peter Zwadyk, Jr., Ph.D. (Iowa, 1971).

Associate Research Professors: Vickers Burdett, Ph.D. (Georgetown, 1973); Lizzie J. Harrell, Ph.D. (North Carolina State, 1978); Sara E. Miller, Ph.D. (Georgia, 1972).

Adjunct Associate Professor: Jeffrey J. Collins, Ph.D. (Harvard, 1972).

Assistant Professors: Harry A. Gallis, M.D. (Duke, 1967); Mariano A. Garcia-Blanco, M.D., Ph.D. (Yale, 1984); Jonathan M. Horowitz, Ph.D. (Wisconsin, 1985); Ross E. McKinney, Jr., M.D. (Rochester, 1979); Michael C. Ostrowski, Ph.D. (South Carolina, 1979); John R. Perfect, M.D. (Med. Coll. of Ohio, 1974); David J. Pickup, Ph.D. (National Institute of Medical Research, London, 1979); Michael F. Seldin, M.D. (Baylor, 1981), Ph.D. (Baylor, 1979); Daniel J. Sexton, M.D. (Northwestern, 1971); Robin P. Wharton, Ph.D. (Harvard, 1986).

Assistant Research Professor: Michael R. Roner, Ph.D. (Miami, 1986).

Adjunct Assistant Professor: Lynn P. Elwell, Ph.D. (Oregon, 1974).

Associate: Donald Komma, Ph.D. (Michigan, 1964).

Research Associates: D. Altschuler, Ph.D.; L. Andrews, Ph.D.; J. Antczak, Ph.D.; D. Antic, Ph.D.; R. Bentley, M.D.; M. Colbert, Ph.D.; A. Darrow, Ph.D.; C. Davies, Ph.D.; K. Hirokawa, M.D.; D. Jin, Ph.D.; S. Kaul, Ph.D.; A. Kelekar, Ph.D.; L. Kotch, Ph.D.; T. Kowalik, Ph.D.; P. Lin, Ph.D.; W. Meyer, Ph.D.; A. Miron, Ph.D.; B. Mohanty, Ph.D.; S. Neece, Ph.D.; S. Pai, Ph.D.; G. Pickett, Ph.D.; T. Sahoo, M.D.; M. Saïta, M.D.; R. Storms, Ph.D.; M. Underhill, Ph.D.; A. Yamamoto, Ph.D.; B.-S. Yang, Ph.D.

Emeritus: Emeritus Chairman Wolfgang K. Joklik, D. Phil.; Suydam Osterhout, M.D. (Duke, 1949), Ph.D. (Rockefeller Inst., 1959); Robert W. Wheat, Ph.D. (Washington Univ., 1955); Hilda P. Willett, Ph.D. (Duke, 1949).

## Required Course

**MIC-200B. Microbiology.** The core course in microbiology for medical students is given during the second semester of the first year. An intensive study is made of the common bacteria, viruses, fungi, and parasites that cause disease in man. The didactic portion of the course focuses on the fundamental biology of micro-organisms causing disease and the molecular mechanisms of the disease process. Attention is given to the host-parasite relationship and the role of the immune system and antimicrobial therapy on this interaction.

The laboratory portion of the course is designed to acquaint students with the basic microbiology techniques employed in the clinical microbiology laboratory, and to provide the basis for an understanding of cell-virus interactions. Medical case histories are presented by the clinical staff to correlate this course with patient care. Weight: 5. *Mitchell*

## Electives

**MIC-252B. General Virology and Viral Oncology.** The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with tumor viruses which are discussed in terms of the virus-cell interaction, the relationship of virus infection to neoplasia, and the application of retroviruses in molecular and developmental biology. Permission of the instructors is required. C-L: IMM 252B; Graduate School. Weight: 4. Min: 5. *Keene, Joklik, Bastia, Kreuzer, Ostrowski, Linney, Nevins, and Pickup*

**MIC-291B. Comprehensive Immunology.** An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and non-specific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses, neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T cell receptor. C-L: IMM 291B; Graduate School. Weight: 4. Max: 10. *Krangel and staff*

**MIC-301B. Principles of Infectious Diseases.** A seminar course to familiarize students with the basic biologic concepts, the pathogenesis and the clinical manifestations of infectious diseases caused by bacteria, viruses, fungi, rickettsia. The host defenses to infectious agents including the acute inflammatory response, humoral and cellular immunity, and current and future trends in the development of vaccines and antimicrobial and antiviral agents will also be discussed. Weight: 3. Min: 10. *Snedeker, Wilfert, Gutman, McKinney, and staff*

**MIC-308B. Clinical Microbiology - Immunology.** A bench-training course in methods used in clinical microbiology stressing isolation and characterization of clinically significant microorganisms. Course conducted in the VA hospital microbiology laboratory. Prerequisites: Permission of instructor. Weight: 8. Max: 4. *Zwadyk*

**MIC-330B. Medical Immunology.** A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable the classes include patient presentations and laboratory demonstrations. C-L: IMM 330B; Graduate School. Weight: 5. *F. Ward and staff*

**MIC-399B. Preceptorship in Microbiology.** An individual reading and/or laboratory course in specialty areas supervised by an individual faculty member. Acceptance,

nature of topic, and amount of credit by individual arrangement with proposed faculty member. Prerequisites: to be determined by instructor. Weight: 1-16. *Staff*

## **COURSES CURRENTLY UNSCHEDULED**

**MIC 259B. Molecular Biology I: Proteins And Enzymes**

**MIC 268B. Molecular Biology II: Nucleic Acids**

**MIC 269B. Advanced Cell Biology**

**MIC 304B. Molecular Membrane Biology**

**MIC 310B. Molecular Development**

**MIC 325B. Medical Mycology**

## **Molecular Cancer Biology**

James B. Duke Professor of Biochemistry: Gordon G. Hammes, Ph.D. (Wisconsin, 1959), *Acting Chairman*.

Assistant Professors: Patrick J. Casey, Ph.D. (Brandeis, 1986); Mariano A. Garcia-Blanco, M.D. (Yale, 1984), Ph.D. (Yale, 1988); Stephen Garrett, Ph.D. (Johns Hopkins, 1986); Jonathan M. Horowitz, Ph.D. (Wisconsin, 1985); Katherine I. Swenson, Ph.D. (Washington, 1983).

## **Neurobiology**

Professor Dale Purves, M.D. (Harvard, 1964), *Chairman*.

Professors: Mohammed Abou-Donia, Ph.D. (California at Berkeley, 1967); Robert P. Erickson, Ph.D. (Brown, 1958); Warren G. Hall, Ph.D. (Johns Hopkins, 1975); William C. Hall (Duke, 1967); David R. McClay, Ph.D. (North Carolina at Chapel Hill, 1971); James O. McNamara, M.D. (Michigan, 1968); J. Victor Nadler, Ph.D. (Yale, 1972); Allen D. Roses, M.D. (Pennsylvania, 1967); Sidney A. Simon, Ph.D. (Northwestern, 1973); Theodore Slotkin, Ph.D. (Rochester, 1970); George G. Somjen, M.D. (Amsterdam, 1956); John Staddon, Ph.D. (Harvard, 1964); Warren J. Strittmatter, M.D. (Duke, 1973); E. Lee Tyrey, Ph.D. (Illinois, 1969); David Warner, M.D. (Wisconsin, 1980).

Associate Professors: George Augustine, Ph.D. (Maryland, 1980); Nell B. Cant, Ph.D. (Michigan, 1973); John H. Casseday, Ph.D. (Indiana, 1970); Joseph M. Corless, M.D. (Duke, 1972), Ph.D. (Duke, 1971); David Fitzpatrick, Ph.D. (Duke, 1982); Lawrence C. Katz, Ph.D. (California Instit. of Tech., 1984); Darrell V. Lewis, M.D. (Minnesota, 1969); William D. Matthew, Ph.D. (California at San Francisco, 1981); Stephen Nowicki, Ph.D. (Cornell, 1984); Donald Schmechel, M.D. (Harvard, 1974); Rochelle D. Schwartz, Ph.D. (Georgetown, 1983); J. H. Pate Skene, Ph.D. (Washington Univ., 1980); Dennis Turner, M.D. (Indiana, 1975); Fulton Wong, Ph.D. (Rockefeller, 1977).

Assistant Professors: Rose-Mary Boustany, M.D. (American University of Beirut, 1979); Robert T. Frembeau, Jr., Ph.D. (George Washington, 1985); David A. Hosford, M.D. (Emory, 1983), Ph.D., (Emory, 1981); Julie A. Kauer, Ph.D. (Yale, 1986); Anthony S. LaMantia, Ph.D. (Yale, 1988); Donald Lo, Ph.D. (Yale, 1989); Richard Mooney, Ph.D. (California Instit. of Tech., 1991); Miguel A. L. Nicolelis, M.D. (Sao Paulo, 1984), Ph.D. (Sao Paulo, 1988); Peter H. Reinhart, Ph.D. (Australian National University, 1985).

Associate Research Professor: Roger D. Madison, Ph.D. (Duke, 1981).

Assistant Research Professors: Ellen Covey, Ph.D. (Duke, 1980); Gillian Einstein, Ph.D. (Pennsylvania, 1984).

Professors Emeritus: Irving T. Diamond, Ph.D. (Chicago, 1952); John W. Moore, Ph.D. (Virginia, 1945); J. David Robertson, M.D. (Harvard, 1945), Ph.D. (Massachusetts Instit. of Tech., 1952).

## **Required Course**

**NBI-202B. Basic Neurobiology.** A systematic introduction to the structure and function of the mammalian nervous system designed specifically for first-year medical students. Lectures, laboratory exercises, clinical presentations and problem-solving conferences during the month of January. Weight: 4. *Purves and staff*

## **Electives**

**NBI-208B. Cellular Neurobiology.** Basic principles of neural electrical activity. Areas of emphasis will include action potential generation, ion channel structure/function relationships, modulation of channel activity, neurotransmitter secretion, transmitter receptors and mechanisms of synaptic plasticity. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3. Max: 5. *Augustine, Kauer, Lo, and Reinhart*



**NBI-209B. Systems Neurobiology.** Structure and function of the mammalian sensory and motor systems. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3 Max: 5. *Cant and Fitzpatrick*

**NBI-211B. Developmental Neurobiology.** The development of the nervous system covering both the history and present status of the major issues in this field. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3. Max: 5. *Purves and Katz*

**NBI-212B. Molecular Neurobiology.** The macromolecules responsible for the specialized functions of neurons and glia. Topics stress the biochemical, molecular, cellular and genetic processes involved in the development and function of the mammalian nervous system. Introductory biochemistry is recommended. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3. Max: 5. *Matthew, Skene, Lo, and LaMantia*

**NBI-399. Research in Neurobiology.** Guided independent study and research experience in neurobiology. Nature of topic to be decided by individual arrangement with faculty advisor. Prerequisite: consent of faculty advisor. Weight: 1-16. *Staff*

## COURSE CURRENTLY UNSCHEDULED

### NBI-266B. Comparative Neurobiology

## Obstetrics and Gynecology

Professor: Charles B. Hammond, M.D., E. C. Hamblen Chair of Reproductive Biology and Family Planning, (Duke, 1961), *Chairman*.

Professors: W. Allen Addison, M.D. (Duke, 1960); Daniel L. Clarke-Pearson, M.D. (Case Western Reserve, 1975); Arthur F. Haney, M.D. (Arizona, 1972); William N.P. Herbert, M.D. (Bowman Gray, 1972); Gale B. Hill, Ph.D. (Duke, 1966); Allen P. Killam, M.D. (Texas, 1960); Warren E. Patow, M.D. (Marquette, 1947); Charles H. Peete, Jr., M.D. (Harvard, 1947); Stanley J. Robboy, M.D. (Michigan, 1965); David W. Schomberg, Ph.D. (Purdue, 1965); E. Lee Tyrey, Ph.D. (Illinois, 1969).

Associate Professors: Andrew Berchuck, M.D. (Case Western Reserve, 1980); Richard C. Bump, M.D. (Ohio State, 1973).

Marvin L. Hage, M.D. (Michigan, 1967); Claude L. Hughes, M.D., Ph.D. (Duke, 1980); Helen Kay, M.D. (Yale, 1979); Charles H. Livengood, III, M.D. (Duke, 1976); Lloyd F. Redick, M.D. (Ohio State, 1958); Patricia M. Saling, Ph.D. (Pennsylvania, 1979); John T. Soper, M.D. (Iowa, 1978).

Associate Clinical Professor: Anna L. Stout, Ph.D. (South Carolina, 1980).

Assistant Professors: Nels C. Anderson, Ph.D. (Purdue, 1964); Kevin E. Bachus, M.D. (Colorado, 1984); Patrick Blohm, M.D. (Rush Medical College, 1988); James D. Bowie, M.D. (Oklahoma, 1967); Grace M. Couchman, M.D. (Colorado, 1985); Phillip C. Greig, M.D. (University of Texas, 1987); Barbara Hertzberg, M.D. (Duke, 1980); Jean Hurteau, M.D. (University of Montreal, 1985); Matthew F. Kohler, M.D. (Duke, 1987); Elizabeth G. Livingston, M.D. (Duke, 1984); Cyrus McCalla, M.D. (SUNY, Stonybrook, 1988); Joanne T. Piscitelli, M.D. (Duke, 1980); Gustavo C. Rodriguez, M.D. (Illinois, 1985); Cynthia Shellhaas, M.D. (Northeastern Ohio, 1988); M. Chrystie Timmons, M.D. (North Carolina at Chapel Hill, 1975); David K. Walmer, M.D., Ph.D. (North Carolina at Chapel Hill, 1983); J. Brice Weinberg, M.D. (Arkansas, 1969).

Assistant Research Professor: Jon R. Wiener, Ph.D. (Virginia, 1984).

Assistant Clinical Professors: Jeffrey C. Andrews, M.D. (Univ. of Toronto, 1983); Nancy L. Bossert, Ph.D. (Northwestern, 1987); Diana Dell, M.D. (Louisiana State, 1982); Richard J. Dwane, M.D. (Georgetown, 1962); Stephen C. Gooding, M.D. (Bowman Gray, 1965); Mary Lee Lobach, M.D. (Vanderbilt, 1984); David L. Richardson, Jr., M.D. (South Carolina, 1973).

Assistant Consulting Professors: James L. Allen, M.D. (Emory, 1965); Paul S. Andrews, M.D. (North Carolina at Chapel Hill, 1981); Arnold B. Barefoot, Jr., M.D. (North Carolina at Chapel Hill, 1982); Rudy W. Barker, M.D. (North Carolina at Chapel Hill, 1967); Mary K. Beckwith, M.D. (Iowa, 1982); Walker H. Campbell, M.D. (Virginia, 1963); Karen H. Clark, M.D. (Alabama, 1982); Vivian E. Clark, M.D. (Boston Univ., 1981); David B. Crosland, M.D. (North Carolina at Chapel Hill, 1958); Yancey G. Culton, Jr., M.D. (Duke, 1956); Jerry L. Danford, M.D. (Duke, 1967); James R. Dingfelder, M.D. (Jefferson Medical College, 1965); Michael D. Fried, M.D. (New York, 1971); Carl A. Furr, Jr., M.D. (North Carolina at Chapel Hill, 1958); Francis S. Gardner Jr., M.D. (Maryland, 1951); Michael D. Gooden, M.D. (North Carolina at Chapel Hill, 1973); Ronald E. Granger, M.D. (California at Irvine, 1977); William B. Gunter, Jr., M.D. (Emory, 1982); William D. Haithcock, M.D. (Med. Univ. of South Carolina, 1973); Joe W. Hardison, M.D. (North Carolina at Chapel Hill, 1965); Perry M. Harmon, M.D. (North Carolina at Chapel Hill, 1974); Charles O. Harris, M.D. (Duke, 1979); Bennet A. Hayes, Jr., M.D. (North Carolina at Chapel Hill, 1957); Melvin I. Henderson, M.D. (Duke, 1978); Wanda L. Jenkins, M.D. (Cincinnati, 1979); Clayton J. Jones, M.D. (Tennessee, 1952); Johnnie E. Jones, M.D. (Meharry, 1976); Glenward T. Keeney, M.D. (Med. Coll. of Virginia, 1967); William

R. Lambeth, M.D. (Bowman Gray, 1974); John W. Lane, M.D. (Duke, 1972); Richard E. Lassiter, M.D. (North Carolina at Chapel Hill, 1965); Stephen C. Lies, M.D. (Duke, 1976); Frank E. Long, M.D. (Maryland, 1975); Jack P. McDaniel, M.D. (North Carolina at Chapel Hill, 1956); Dudley C. Miller, M.D. (Missouri, 1959); James P. Moon, M.D. (South Dakota, 1979); William A. Nebel, M.D. (North Carolina at Chapel Hill, 1962); Phillip H. Pearce, M.D. (Duke, 1960); Marla M. Presta, M.D. (Chicago, 1982); Steven M. Scott, M.D. (Indiana, 1974); E. Frank Shavender, M.D. (North Carolina at Chapel Hill, 1968); W. Siegfried Smith, Jr. M.D. (Duke, 1961); Thomas A. Stokes, M.D. (Duke, 1955); Allen H. Van Dyke, Jr., M.D. (Bowman Gray, 1971); Paul A. Vieta, M.D. (New Jersey, 1966); Bertram E. Walls, M.D. (Duke, 1972); Robert K. Yowell, M.D. (Duke, 1961).

Research Associates: Deborah Burks, Ph.D. (Vanderbilt, 1990); Rosa Carballada, Ph.D. (Madrid, Spain, 1992); Lisette Leyton, Ph.D. (Univ. of Chile, 1989); Claudia Tomes, Ph.D. (Universidad de Buenos Aires, 1991).

Associates: Alaa Elbendary, M.D. (Loyola, 1989); Lisa Hansard, M.D. (Texas A&M, 1989); Becky Ann Heide, M.D. (Univ. of Missouri, 1984); Pamela L. Johnson, M.D. (Illinois, 1989); Evan R. Myers, M.D. (Pennsylvania, 1988); Sharon L. Rupp, B.S., A.A.S.; James Theofrastous, M.D. (Vermont, 1987).

Clinical Associates: Elizabeth J. Burkett, B.S.N., M.S.N.; Lorraine Fry-Mehlretter, M.S.; Rebecca M. Ryder, M.D. (North Carolina at Chapel Hill, 1989).

Consulting Associates: Kerry H. Ainsworth, M.D. (Northwestern, 1962); Avis A. Artis, M.D. (Duke, 1984); Linda K. Bresnahan, M.D. (Indiana, 1987); Pat C. Bryan, M.D. (North Carolina at Chapel Hill, 1983); Christie L. Clayton, M.D. (East Carolina University, 1986); Cathryn L. Crosland, M.D. (Kentucky at Lexington, 1983); Gerianne Geszler, M.D. (Duke, 1985); Daniel L. Gottsegen, M.D. (Tufts, 1969); Stuart H. Jordan, M.D. (North Carolina at Chapel Hill, 1985); Glen A. Nowachek, M.D. (Loyola, 1982); Russel F. Palmeri, M.D. (Georgetown, 1980); Kathy A. Santoriello, M.D. (Duke, 1984); Ira Q. Smith, M.D. (Bowman Gray, 1979); Myron S. Strickland, Sr., M.D. (East Carolina, 1984); Camille J. Wahbeh, M.D. (American Univ. of Beirut, 1977).

Professor Emeritus: Arthur C. Christakos, M.D. (Med. Coll. of South Carolina, 1955); Roy T. Parker, M.D. (Med. Coll. of Virginia, 1944); Warren E. Patow, M.D. (Marquette, 1947).

Adjunct Assistant Professor: Neil J. Finkler, M.D. (Mount Sinai, 1982).

## Required Course

In Introduction to Clinical Medicine the first-year student receives instruction in the fundamentals of obstetric and gynecologic history and pelvic examinations.

**OBG-205C. Obstetrics and Gynecology.** Required of all second-year students—consists of eight weeks in general obstetrics and gynecology. Students attend lectures, work daily in the general and special outpatient clinics, and are assigned patients on the obstetric and gynecologic wards. Students share in patient care, teaching exercises, and in daily tutorial sessions with the faculty. Clinical conferences, a gynecologic-pathology conference, endocrine conferences, and correlative seminars and lectures are included. Weight: 8. *Hage*

## Electives

**OBG-210C. Gynecologic Cancer.** This course presents a clinical experience in the management of patients with a gynecologic malignancy. The student will assume the role of an extern. Outpatient, inpatient, and operative exposure to these patients will be extensive. Weight: 4 or 8. Max: 1. Clarke-Pearson, Soper, Berchuck, Rodriquez and fellows on gynecology

**OBG-213C. Preparation for Practice, Cape Fear Valley Hospital, Fayetteville AHEC.** This is a unique opportunity to receive both didactic exposure and clinical experience in obstetrics and gynecology in Cape Fear Valley Hospital, a large community hospital in Fayetteville, North Carolina, where almost 4,000 patients are delivered each year. A student will actively participate in the care of patients in the labor and delivery room, assist at surgery, and render postoperative care. This is a community hospital experience rather heavily weighted in clinical obstetrics. Students will be exposed to a large volume of clinic opportunities. Three senior residents from Duke rotate through Cape Fear Valley Hospital. The students will be directly supervised by three full-time Duke faculty at Cape Fear, in addition to Duke Ob-Gyn residents. Prerequisites: permission of Dr. Hammond prior to signing for the course. Check availability through Dr. Gooding's office. Weight: 4. Max: 1. *Hammond, Gooding, Richardson, Patow, and staff of Cape Fear Valley Hospital*



**OBG-231C. Clinical Reproductive Endocrinology.** Course for students who desire additional basic and clinical experience in examination, diagnosis, and treatment of obstetric and gynecologic patients with endocrinopathy and infertility. Course consists of instruction in clinical reproductive problems correlated with examination and treatment of patients both in the Endocrinology Outpatient Clinic and in the hospital. Permission of instructor required. Weight: 4. Max: 1. *C. Hughes, Haney, Hammond, Walmer, Bachus, and reproductive endocrinology fellows*

**OBG-239C. Perinatal Medicine.** A study of the relationship of clinical factors during pregnancy, labor, delivery, and the first month of life. Emphasis will be placed on abnormal conditions of pregnancy as related to the infant, prenatal pathological conditions adversely affecting the fetus and the newborn, and early management of the infant. Current problems in the maternal-fetal relationships will be outlined. The clinical rotation will consist of half-time on the high risk obstetric service and half on the nursery service. Duke North ICN or Duke North Nurseries. See also PED 225C. Prerequisites: must contact Dr. Herbert prior to registration. Weight: 8. Max: 2. *Herbert, Killan, Hage, Kay, Livingston, Grieg, and fellows MFM Division*

**OBG-243C. Human Sexuality.** This is an opportunity for all medical students to become more comfortable with talking about sexual issues. Students will act as discussion group leaders for a Duke undergraduate course in human sexuality. Discussion facilitation rather than didactic teaching is emphasized. Weight: 1. Max: 30. *Stout*

**OBG-245C. Office Gynecology.** For students preparing for non ob-gyn careers. Out-patient clinic diagnosis and patient care are taught. Weight: 4 or 8. Max: 2. *Dwane and staff*

**OBG-247C. Clinical Obstetrics.** For students preparing for general practice of medicine, pediatrics, or obstetrics and gynecology. This course will study the relationship of clinical factors during pregnancy, labor, and delivery. Emphasis will be placed on abnormal conditions of pregnancy as related to the infant. Current problems in the maternal-fetal relationship will be outlined. The student will function on an intern level and take part in activities of the housestaff and faculty. Weight: 5 or 10. Max: 2. *Herbert, Killam, Hage, Kay, Livingston, Grieg, and fellows on obstetrical service*

**OBG-249C. Clinical Gynecology.** For students preparing for obstetrics and gynecology, general practice, surgery, and urology. Emphasis is placed on the outpatient assessment of patients with acute and chronic gynecologic disorders including benign neoplasia, loss of pelvic support, menopausal symptomatology, and others. Students will have the opportunity to work closely with faculty members in the Division of Gynecology. Inpatient care is not required, but participation in the operative care of gynecologic patients can be arranged if desired. Ample time for independent study is planned. It is anticipated that the student will utilize this time reviewing a specific clinical problem with frequent guidance and input from a member of the Gynecology Division with similar interests. Weight: 4 or 8. Max: 1. *Addison, Peete, Livengood, Piscitelli, Timmons, and Bump*

**OBG-253C. Preparation for Practice, Cabarrus Memorial Hospital, Concord, North Carolina.** This is an opportunity to receive both didactic exposure and clinical exposure in obstetrics and gynecology in the community hospital. The student will be expected to function as an intern. The student will participate actively in the care of the patients in the labor and delivery area, assist at surgery, and render postpartum and postoperative care. This is a community hospital experience rather heavily weighted in clinical obstetrics. The student will be exposed to a large volume of clinical material. The practitioners in the community are all board certified obstetricians and gynecologists and are interested in student teaching. A Duke faculty person will provide additional guidance by visits once per week. This elective can be taken for four weeks for four units or eight weeks for eight units. The students will be housed in quarters available for them.



Prerequisites: permission of Dr. Livengood prior to signing for the course. Weight: 4, 6, or 8 Max: 1. *Livengood and staff of the Cabarrus Memorial Hospital*

## Ophthalmology

Professor: David L. Epstein, M.D. (Johns Hopkins, 1968), *Chairman*.

Professors: W. Banks Anderson, Jr., M.D. (Harvard, 1956); Edward G. Buckley, M.D. (Duke 1977); Jonathan G. Dutton, M.D. (Washington, 1977), Ph.D. (Harvard, 1970); Gary N. Foulks, M.D. (Columbia, 1970); Diane Van Horn Hatchell, Ph.D. (Marquette, 1968); Joseph A. C. Wadsworth Research Professor of Ophthalmology Gordon K. Klintworth, M.D. (Univ. of Witwatersrand, 1957), Ph.D. (Univ. of Witwatersrand, 1966); Helena Rubinstein Foundation Professor of Ophthalmology Robert Machemer, M.D. (Freiburg, Germany, 1959); Brooks W. McCuen II, M.D. (Columbia, 1974); M. Bruce Shields, M.D. (Oklahoma, 1966).

Associate Professors: Judy H. Seaber, Ph.D. (Duke, 1985); Fulton Wong, Ph.D. (Rockefeller, 1977); Alan D. Proia, M.D. (Cornell, 1980), Ph.D. (Rockefeller, 1979).

Assistant Professors: R. Rand Allingham, M.D. (Med. Coll. of Cincinnati, 1979); Joseph Corless, M.D., Ph.D. (Duke, 1972); Monica A. De La Paz, M.D. (Stanford, 1987); Craig Fowler, M.D. (Med. Coll. of Virginia, 1985); Sharon F. Freedman, M.D. (Harvard, 1985); Peter C. Huttemeier, M.D. (Univ. of Copenhagen, 1977); Glenn J. Jaffe, M.D. (California at San Francisco, 1983); Stephen C. Pollock, M.D. (Illinois, 1981); Angela Royster Scott, M.D. (North Carolina, 1990); Cynthia Toth, M.D. (Med. Coll. of Pennsylvania, 1983).

Assistant Clinical Professor: Calvin H. Mitchell, M.D. (Duke, 1958).

Assistant Research Professors: E. Timothy O'Brien, Ph.D. (California at Santa Barbara, 1986); Joel R. Ross, Ph.D. (Texas at Southwestern, 1991).

Associate Consulting Professors: Edward K. Isbey, Jr., M.D. (Michigan, 1955); Lawrence W. Moore, Jr., M.D. (Duke, 1963).

Assistant Consulting Professors: David P. Berry, M.D. (South Carolina, 1975); John E. Bourgeois, M.D. (Virginia, 1979); David J. Browning, M.D. (Duke, 1981) Ph.D. (Duke, 1980); Terry A. Cox, M.D. (Kansas, 1975); Anne Marie Hanneken, M.D. (Med. Coll. of Wisconsin, 1984); Edward K. Isbey III, M.D. (North Carolina at Chapel Hill, 1981); Jeremiah R. Marion, M.D. (Duke, 1975); Walter C. McLean, Jr., M.D. (Virginia 1975); Charles F. Sydnor, M.D. (Virginia, 1969).

Consulting Associates: Thomas L. Beardsley, M.D. (Duke, 1971); J. Thomas Foster, M.D. (Duke, 1958); William R. Harris, M.D. (North Carolina at Chapel Hill, 1956); Ann Kathryn Joslyn, M.D. (Duke, 1983); John H. Killian, M.D. (Bowman Gray, 1967); Martin J. Kreshon, M.D. (Marquette, 1954); W. Hampton Lefler, M.D. (Bowman Gray, 1963); Harold E. Shaw, Jr., M.D. (Med. Univ. of South Carolina, 1973); Robert E. Wiggins, M.D. (North Carolina at Chapel Hill, 1984).

Emeritus: Joseph A. C. Wadsworth, M.D.

## Electives

**OPH-210C. Medical Ophthalmology.** The ophthalmic signs and symptoms of systemic disease are presented in a lecture series. Oriented for those students interested primarily in pediatrics, internal medicine, or ophthalmology. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 6 Max: 20. *Shields and Mitchell*

**OPH-212C. General Ophthalmology.** A clinical preceptorship in which the student participates and observes the regular house staff activities, conferences, lectures, patient care, and treatment including surgery. Emphasis on the use of specialized ophthalmic apparatus is emphasized. Prerequisites: OPH-210C recommended, but not required. Weight: 4 or 8 Max: 2. *Shields*

**OPH-213C. Ophthalmic Pathology.** The student reviews all ophthalmic pathology specimens submitted and any pertinent permanent specimens. He or she attends all regular ongoing ophthalmic pathology conferences. Prerequisites: OPH-212C and OPH-210C recommended, but not required. Not available during the summer term. Weight: 1. *Klintworth and Proia*

**OPH-214C. Investigative Ophthalmology.** The student is assigned a project relating to basic ophthalmologic problems. Technical assistance, sufficient equipment, and laboratory animals are supplied for the completion of the project. The student is expected to attend all scheduled research seminars. Prerequisites: OPH-212C and OPH-210C

suggested, but not required. Student must devote at least three months to the elective. Weight: 4 or 8 Max: 2. *Klintworth, Hatchell, Wong, Proia, Jaffe, Epstein, and DeLaPaz*

**OPH-215C. Pediatric Ophthalmology.** A clinical preceptorship in which the student participates in an outpatient pediatric ophthalmology clinic. The student encounters the more common ocular disorders of childhood including ocular motility disturbances, congenital disorders, and congenital metabolic disorders. The diagnosis and treatment aspects are emphasized heavily. The course meets on Tuesdays or Thursdays from 9:00 a.m. till 4:00 p.m. or by special arrangement, such as a half day Tuesday and a half day Thursday. Additional experiences, which would include surgery and/or pediatric neuro-ophthalmology, can be arranged. Weight: 1 or 2 Max: 3. *Buckley and Seaber*

**OPH-216C. Clinical Neuro-Ophthalmology.** An advanced clinical preceptorship that provides students with exposure to a variety of neuro-ophthalmologic problems, including diseases affecting the optic nerve and central visual pathways and disorders of eye movement. Emphasis is placed on history taking, acquisition of specialized examination techniques (visual fields, pupils, ocular motility and fundus), and the logical analysis of clinical information. The course meets one day per week, either on Tuesday or Thursday and begins at 8:30 a.m. Prerequisites: OPH 212C. Weight: 1 Max: 1. *Pollock*

## Pathology

Professor: Salvatore Pizzo, M.D. (Duke, 1972), Ph.D. (Duke, 1973), *Chairman*.

Professors: Dolph O. Adams, M.D. (Med. Coll. of Georgia, 1965); Ph.D. (North Carolina at Chapel Hill, 1969); Darell D. Bigner, M.D. (Duke, 1965), Ph.D. (Duke, 1971); Sandra H. Bigner, M.D. (Tennessee, 1971); Edward H. Bossen, M.D. (Duke, 1965); William D. Bradford, M.D. (Western Reserve, 1958); Peter C. Burger, M.D. (Northwestern, 1966); Doyle G. Graham, M.D. (Duke, 1966), Ph.D. (Duke, 1971); James B. Duke Professor Robert B. Jennings, M.D. (Northwestern, 1950); William W. Johnston, M.D. (Duke, 1959); Gordon K. Klintworth, M.D. (Univ. of Witwatersrand, 1957), Ph.D. (Univ. of Witwatersrand, South Africa, 1966); Keith A. Reimer, M.D. (Northwestern, 1972); L. Barth Reller, M.D. (Virginia, 1966); Stanley J. Robboy, M.D. (California at Los Angeles, 1965); Victor L. Roggli, M.D. (Baylor, 1976); John D. Shelburne, M.D., (Duke, 1972), Ph.D. (Duke, 1971); Joachin R. Sommer, M.D. (Munich, 1951); Benjamin Wittels, M.D. (Minnesota, 1952).

Adjunct Professors: Paul Nettesheim, M.D., D.M.S. (Bonn, West Germany, 1959); Vladimir Petrow, Ph.D. (Univ. of London, 1936), D.Sc. (Univ. of London, 1942); Nicholas Vick, M.D. (Chicago, 1965); Alfred P. Sanfilippo, Ph.D. (Duke, 1975), M.D. (Duke, 1976).

Associate Professors: James D. Crapo, M.D. (Rochester, 1971); Peter D. Issitt, Ph.D. (Columbia Pacific, 1987); Lester Layfield, M.D. (California at Los Angeles, 1979); Alan D. Proia, M.D. (Cornell, 1980), Ph.D. (Rockefeller, 1979); John Toffaletti, Ph.D. (North Carolina at Chapel Hill, 1977); Frances King Widmann, M.D. (Case Western Reserve, 1960); Peter Zwadyk, Jr., Ph.D. (Iowa, 1971).

Clinical Associate Professor: Emily A. G. Reisner, Ph.D. (Case Western, 1969).

Adjunct Associate Professor: James A. Swenberg, D.V.M. (Minnesota, 1966), Ph.D. (Ohio, 1970).

Assistant Professors: Surinder Kumar Batra, Ph.D. (NDRI, Karnal, 1982); Rex Bentley, M.D. (Harvard, 1986); Scott Berkowitz, M.D. (Jefferson, 1979); Steven J. Bredehoeft, M.D. (Kansas, 1974); Alice Coogan, M.D. (Vanderbilt, 1988); Kenneth Copeland, Ph.D. (Univ. of Manitoba, Canada, 1991); Dianne DeCamp, Ph.D. (Delaware, 1988); Mark W. Dewhirst, D.V.M. (Colorado State, 1975), Ph.D. (Colorado State, 1979); Leslie Dodd, M.D. (Nevada, 1987); Jan Enghild, Ph.D. (Univ. of Aarhus, Denmark, 1987); Henry S. Friedman, M.D. (New York at Syracuse, 1977); Marcia Gottfried, M.D. (Northwestern, 1978); Charles S. Greenberg, M.D. (Hahnemann, 1976); John Guyton, M.D. (Harvard, 1973); John M. Harrelson, M.D. (Duke, 1965); Maureen Hoffman, M.D. (Iowa, 1982), Ph.D. (Iowa, 1982); David Howell, M.D. (Duke, 1984), Ph.D. (Duke, 1982); Christine M. Hulette, M.D. (Louisville, 1983); Randy H. Jirtle, Ph.D. (Wisconsin, 1976); William Kane, M.D., Ph.D. (Washington Univ., 1982); Hannah Krigman, M.D. (North Carolina, 1988); Joanne Kurtzberg, M.D. (New York Med. Coll. 1976); Richard M. Levenson, M.D. (Michigan, 1979); James G. Lewis, Ph.D. (Duke, 1982); James E. Lowe, M.D. (California at Los Angeles, 1973); Kim Lyster, M.D. (California at Los Angeles, 1983); Gail Macik, M.D. (Texas Health Sciences Center, 1983); Roger C. McLendon, M.D. (Med. Coll. of Georgia, 1982); Karen Mann, M.D. (Tufts, 1988), Ph.D. (Tufts, 1988); Sara Miller, Ph.D. (Georgia, 1982); L. Darryl Quarles, M.D. (Alabama, 1979); Mazin B. Qumsiyeh, Ph.D. (Texas Tech, 1986); Howard Ratech, M.D. (Albany Med. Coll., 1976); Guy S. Salvesson, Ph.D. (Cambridge Univ., 1980); David Sane, M.D. (Duke, 1983); Jonathan I. Scheinman, M.D. (Illinois, 1966); Daniel I. Schenkman, D.V.M. (Purdue, 1979), Ph.D. (Wisconsin, 1986); Charles Steenbergen, M.D. (Pennsylvania, 1978), Ph.D. (Pennsylvania, 1979); Marilyn Telen, M.D. (New York Univ., 1977); Philip J. Walther, M.D. (Duke, 1975),



Ph.D. (Duke, 1974); Mary Kay Washington, M.D. (North Carolina at Chapel Hill, 1986); Michael R. Zalutsky, Ph.D. (Washington Univ., 1974).

Assistant Clinical Professors: John A. Bittikofer, Ph.D. (Purdue, 1971); Jane Gaede, M.D. (Duke, 1966); Robert B. Kinney, M.D. (Duke, 1981); Richard J. Rahija, D.V.M. (Kansas, 1974), Ph.D. (North Carolina at Chapel Hill, 1989); Margaret C. Schmidt, M.A., (Louisville, 1969), Ed.D. (Duke, 1988); Frank A. Sedor, Ph.D. (Florida, 1971); Robin T. Vollmer, M.D. (Duke, 1967); Cynthia Wells, M.Ed. (Duke, 1978), D.Ed. (Duke, 1984).

Assistant Research Professors: Venkataraman Amamath, Ph.D. (Carnegie-Mellon, 1973); Gerald E. Archer, Jr., Ph.D. (Cincinnati, 1987); Steven S. Geier, Ph.D. (Duke, 1978); Mario Gonzalez-Gronow, D.Sc. (Chile, 1970); Stewart Johnson, Ph.D. (Case Western Reserve, 1983); B. K. Ahmed Rasheed, Ph.D. (Indian Instit. of Science, India, 1981); William M. Valentine, Ph.D. (Illinois at Chicago, 1983), D.V.M. (Illinois at Urbana, 1985).

Associate Research Professors: Carol W. Lewis, Ph.D. (North Carolina at Chapel Hill, 1972).

Adjunct Assistant Professors: Arnold R. Brody, Ph.D. (Colorado, 1969); John Butts, M.D. (Duke, 1972); Thomas B. Clark III, M.D. (Med. Univ. of South Carolina, 1983); Lynn Crook, Ph.D. (Emory, 1966), M.D. (Med. Univ. of South Carolina, 1974); Arthur Davis, M.D. (Minnesota, 1953); Jochen Fischer, Ph.D. (University of Stuttgart/Germany, 1993); Peter Ingram, Ph.D. (Univ. of Southampton, England, 1967); Myla Lai-Goldman, M.D. (Columbia, 1983); Ralph C. McCoy, M.D. (Emory, 1967); James Alan Popp, D.V.M. (Ohio State, 1968), Ph.D. (California at Los Angeles, 1972); Jerry E. Squires, Ph.D. (Yale, 1971), M.D. (West Virginia, 1974); Peter Wentz, Ph.D. (Florida, 1972).

Associate: Kenneth R. Broda, Ph.D. (Duke, 1977).

Emeritus: Bernard F. Fetter, M.D. (Duke, 1944); John A. Koepke, M.D. (Wisconsin, 1956); Phillip C. Pratt, M.D. (Johns Hopkins, 1944); Kenneth A. Schneider, M.D. (Northwestern, 1959); F. Stephen Vogel, M.D. (Western Reserve, 1944).

## Required Course

**PTH-200C. Pathology.** The core course in pathology is given during the second term of the first year. Fundamentals of pathology are presented by correlating gross and microscopic material to illustrate the structural changes in disease. Lectures dealing with broad concepts of disease processes are presented by senior faculty, and conferences with small groups of students are held under the guidance of staff members. Etiology and pathogenesis of disease, as well as the experimental approach are emphasized for the purpose of correlation with clinical disease. In addition to group work, conferences are scheduled to discuss problems derived from autopsies. Students are required to collaborate in postmortem studies and present cases in clinical-pathologic conferences under the direction of the staff. Weight: 5. *Steenbergen*

## Electives

**PTH-223B or C. Autopsy Pathology.** The course is intended to introduce students to the autopsy as an investigative tool. Anatomic-clinical correlation is emphasized. Students work directly with one or more members of the Pathology Department. They first assist at autopsies and then perform autopsies under supervision. They work up these cases with particular attention to correlations with clinical and experimental medicine, prepare the final autopsy reports, and work essentially at the level of a house officer. Students are expected to present their findings at staff conferences. Preference given to Pathology Study Program students. Weight: 4 or 8 Max: 3. *Proia*

**PTH-225B. Cardiovascular Pathology.** The anatomic and pathophysiologic basis of cardiovascular disease are covered through lectures, workshops, laboratory study of preserved hearts and case material, and student seminars. Subject matter includes congenital heart disease (prefaced by normal cardiac anatomy and embryology), ischemic heart disease and the effects of interventional therapy, valvular heart disease, cardiomyopathies, cardiac transplantation, and tumors. Weight: 2 Min: 8 Max 32. *Reimer, Steenbergen, and Jennings*

**PTH-241B. Pathologic Basis of Clinical Medicine.** This is a lecture course stressing clinicopathologic correlation, morphologic diagnosis, pathophysiology, and laboratory medicine. It is required for students enrolled in the Pathology Study Program, but is available as a separate elective for all students. Lectures are on Thursday 8:00 - 9:30 a.m.



and Friday 12:00 - 1:00 p.m. Course must be taken for the entire year. No audits are allowed. Weight: 1. *Bradford, Reimer, and Hoffman*

**PTH-242C. Laboratory Basis of Clinical Medicine.** This is an intensive four week lecture/demonstration experience in basic and practical aspects of diagnostic laboratory medicine. Clinically relevant aspects of immunology, hematopathology, virology, chemistry, transfusion medicine, and molecular diagnostics directly related to patient testing are presented and discussed by a multidisciplinary faculty. Information gained in this course is useful to all physicians who care for patients and who use a hospital laboratory. Although geared to trainees in laboratory medicine this course prepares the medical student in the discriminating use of the modern hospital laboratory. Prerequisites: permission of Dr. Bradford. Weight: 4 Max: 8. *Pizzo, Reisner, Bredehoeft, and Bradford*

**PTH-281B or C. Cytopathology Preceptorship.** This course consists of full-time rotation in the diagnostic cytopathology laboratories. By working with the laboratory staff, the student explores in detail the role played by diagnostic cytopathology in the diagnosis of disease. In addition to general cytology, the student has the opportunity to participate in the fine needle aspiration biopsy service. Although not a requirement, the student is encouraged to pursue special research projects. Preference given to Pathology Study Program students. Weight: 4 or 8 Max: 1. *Johnston, Bigner, Layfield, Coogan, Dodd, and cytopathology staff*

**PTH-342B. Special Topics in Pathology.** Special problems in pathology are studied with a member of the senior staff. The subject matter is individually arranged. Permission of the instructor required. Weight: 1-16. *Pizzo and staff*

**PTH-348B or C. Practical Surgical Pathology.** This course serves as an apprenticeship in which the student works closely with residents in the actual preparation and diagnosis of tissue changes. Microscope required (limited number available on loan). Prerequisites: permission of Dr. Bradford. Preference given to Pathology Study Program students. Weight: 4 or 8 Max: 2. *Layfield and staff*

**PTH-353B. Neuropathology.** A view of neuropathology that emphasizes clinicopathologic correlation. Weight: 3. *Graham and staff*

**PTH-359B. Fundamentals of Electron Microscopy.** Emphasis is placed on the theory and application of electron microscopy to ultrastructural pathology. The methods relating to electron microscopy as well as x-ray microanalysis, ion microscopy, and immunocytochemistry are considered. Laboratory experience is included. Weight: 3. *Shelburne, Sommer, Ingram, and LeFurgey*

**PTH-364B. Skeletal Pathology.** An overview of skeletal pathology beginning with the development of the normal skeleton. A systematic review of inflammatory, neoplastic, metabolic, arthritic, vascular, dysplastic, and traumatic diseases of the skeleton. Clinical correlation. Weight: 2 Min: 4 Max: 10. *Harrelson*

**PTH-366B. Pulmonary Pathology and Pathophysiology.** Emphasis is on pulmonary pathology and pathophysiology of infections, metabolic, environmental, neoplastic diseases, and certain diseases of unknown etiology (sarcoid, alveolar proteinosis, e.g.). Weight: 3 Min: 2 Max: 15. *Roggli*

**PTH-380B or C. Surgical Pathology-Emphasis: Electron Microscopy.** This course is an apprenticeship in which the student becomes engaged in the actual preparation and diagnosis of tissue changes using both light and electron microscopy. The student, of necessity, learns how to operate the electron microscope. Prerequisites: PTH 359B suggested, but not required. Permission of instructor is required. Weight: 4 or 8 Max: 1. *Shelburne and Vollmer*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

PTH 231B. Ophthalmic Pathology  
PTH 346B. Subcellular and Molecular Pathology  
PTH 378B. Seminars in Hematology

## Pediatrics

Samuel L. Katz Professor Michael M. Frank, M.D. (Harvard, 1960), *Chairman*.

Professors: Page A. W. Anderson, M.D. (Duke, 1963); George Bisset, III, M.D. (South Florida, 1975); James B. Sidbury Professor Rebecca H. Buckley, M.D. (North Carolina at Chapel Hill, 1958); Y.T. Chen, M.D. (Taiwan Univ., 1973), Ph.D. (Columbia, 1978); John M. Falletta, M.D. (Kansas, 1966); John W. Foreman, M.D. (Maryland, 1973); Henry S. Friedman, M.D. (New York at Syracuse, 1977); Arthur Garson, M.D. (Duke, 1974), M.P.H. (Texas at Houston, 1992); Herman Grossman, M.D. (Columbia, 1953); Wilburt C. Davison Professor Samuel L. Katz, M.D. (Harvard, 1952); Thomas R. Kinney, M.D. (Duke, 1970); Joanne Kurtzberg, M.D. (New York Med. Coll., 1976); Keith T. Oldham, M.D. (Med. Coll. of Virginia, 1976); Jeffrey L. Platt, M.D. (Southern California, 1977); Mark C. Rogers, M.D. (SUNY, Upstate, 1969); Charles R. Roe, M.D. (Duke, 1964); James B. Duke Professor Madison S. Spach, M.D. (Duke, 1954); Alexander Spock, M.D. (Maryland, 1955); Catherine M. Wilfert, M.D. (Harvard, 1962).

Associate Professors: Brenda E. Armstrong, M.D. (St. Louis, 1974); Roger C. Barr, Ph.D. (Duke, 1968); Rose-Mary Boustany, M.D. (Amer. Univ. of Beirut, Lebanon, 1979); Edward G. Buckley, M.D. (Duke, 1977); G. Robert DeLong, M.D. (Harvard, 1961); Peter C. English, M.D., Ph.D. (Duke, 1975); Michael S. Freemerk, M.D. (Duke, 1976); Michael L. Graham, M.D. (Brown, 1975); William J. Greeley, M.D. (Texas at Houston, 1976); Laura T. Gutman, M.D. (Stanford, 1962); Edward Halperin, M.D. (Yale, 1979); Frank Kern, M.D. (Pennsylvania, 1982); Allen P. Killam, M.D. (Texas at Galveston, 1960); Lowell R. King, M.D. (Johns Hopkins, 1956); Darrell V. Lewis, Jr., M.D. (Minnesota, 1969); John G. Looney, M.D. (Texas, Southwestern, 1969); Ross E. McKinney, Jr., M.D. (Rochester, 1979); Jon N. Meliones, M.D. (Tufts, 1984); Thomas M. Murphy, M.D. (Rochester, 1973); Martin P. O'Laughlin, M.D. (Columbia, 1980); Neil Prose, M.D. (New York University, 1975); Raymond A. Sturner, M.D. (Georgetown, 1968); David T.H. Tanaka, M.D. (Johns Hopkins, 1979); Ross M. Ungerleider, M.D. (Rush, 1977); Russell E. Ware, M.D. (Duke, 1983), (Duke, 1991); Jo Rae Wright, Ph.D. (West Virginia, 1981).

Assistant Professors: P. Ian Andrews, M.B., B.S. (Univ. New South Wales, Sydney, Australia, 1978); Richard Auten, M.D. (North Carolina at Chapel Hill, 1981); A. Resai Bengur, M.D. (Med. Univ. of South Carolina, 1982); William D. Bradford, M.D. (Western Reserve, 1958); Iley B. Browning III, M.D. (North Carolina at Chapel Hill, 1982); Janet Casey, M.D. (Western Reserve Univ., 1987); Dennis A. Clements, M.D. (Rochester, 1973), M.P.H. (North Carolina at Chapel Hill, 1988), Ph.D. (North Carolina at Chapel Hill, 1990); John Fowlkes, M.D. (Texas at San Antonio, 1985); Sharon Freedman, M.D. (Harvard, 1985); J. William Gaynor, M.D. (Med. Univ. South Carolina, 1982); Jeannine L. Gingras, M.D. (Vermont, 1978); Ricki F. Goldstein, M.D. (Cornell, 1981); Terry O. Harville, M.D. (Florida, 1986), Ph.D. (Florida, 1982); A. Kimberly Iafolla, M.D. (Pittsburgh, 1984); J. David Jones, M.D. (Duke, 1954); Ronald J. Kanter, M.D. (Vanderbilt, 1979); Mary J. Laughlin, M.D. (SUNY, Buffalo, 1988); Darryl C. Longee, M.D. (Arkansas, 1983); Samuel M. Mahaffey, M.D. (West Virginia, 1979); J. Marc Majure, M.D. (Mississippi, 1981); M. Louise Markert, M.D., (Duke, 1982), Ph.D. (Duke, 1981); J. Clarke McIntosh, M.D. (Med. Univ. South Carolina, 1981); Charles P. McKay, M.D. (Louisiana, 1980); Kathy A. Merritt, M.D. (Duke, 1985); Cindy Miller, M.D. (George Washington, 1985); Karen J. O'Donnell, Ph.D. (North Carolina at Chapel Hill, 1983); Janice Olson, M.D. (Utah, 1985); Aglaia N. O'Quinn, M.D. (Duke, 1965); Shirley K. Osterhout, M.D. (Duke, 1957); Mazin Qumsiyeh, Ph.D. (Texas Tech, 1986); M. Henderson Rourk, Jr., M.D. (Pennsylvania, 1963); Julie D. Saba, M.D. (Maryland, 1985); Scott Schulman, M.D. (George Washington, 1982); Jeffrey D. Snedeker, M.D. (Wisconsin, 1982); Deborah L. Squire, M.D. (Northwestern, 1978); Robert J. Thompson, Jr., Ph.D. (North Dakota, 1971); Kathryn Thrailkill, M.D. (Ohio State, 1983); Mary E.L. Vernon, M.D. (Columbia, 1976); Judith A. Voynow, M.D. (Univ. Pennsylvania, 1982); Emmanuel B. Walter, M.D. (Maryland, 1983); Delbert R. Wigfall, M.D. (Emory, 1979); Larry Williams, M.D. (Duke 1977).

Associates: Jeffrey Baker, M.D. (Duke, 1984); Robert P. Drucker, M.D. (Duke, 1979); Sandra Hosford, M.D. (Duke, 1986); Cheryl Jackson, M.D. (Pennsylvania, 1987); Jennifer Lawson, M.D. (Vermont, 1990); Jennifer Li, M.D. (Duke, 1987); Catharine Moffitt, M.D. (South Florida, 1988); John W. Moses, Jr., M.D. (Med. Univ. South Carolina, 1983); Dennis Rosenblum, M.D. (Boston, 1986); Laura Schanberg, M.D. (Duke, 1984); Roberts H. A. Smith, M.D. (Texas, Houston, 1990); Karen K. St. Claire, M.D. (Texas at Galveston, 1982).

Clinical Professors: Norman S. Talner, M.D. (Michigan, 1949); W. Samuel Yancy, M.D. (Duke, 1965).

Associate Clinical Professors: Stephen G. Kahler, M.D. (Duke, 1973); Deborah W. Kredich, M.D. (Michigan, 1962); Mary Ann Morris, M.D. (Arkansas, 1972); Lois A. Pounds, M.D. (Pittsburgh, 1965); Richard I. Schiff, M.D., Ph.D. (Duke, 1976); Gordon Worley, M.D. (Harvard, 1973).

Assistant Clinical Professors: Nancy E. Friedman, M.D. (Med. Coll. of Virginia, 1975); Karen H. Frush, M.D. (Duke, 1986); Barbara J. Howard, M.D. (Johns Hopkins, 1975); Martha Ann Keels, D.D.S. (North Carolina at Chapel Hill, 1984), Ph.D. (North Carolina at Chapel Hill, 1990); Ave Maria Lachiewicz, M.D. (Minnesota, 1980); Rupa Redding-Lallinger, M.D. (Cornell, 1980); Christine Rudd,



Pharm.D. (North Carolina at Chapel Hill, 1973); Gail Spiridigliozzi, Ph.D. (Kansas, 1988); Marjorie E. Tripp, M.D. (Yale, 1973).

Clinical Associates: Joanne Barton, Dr.P.H. (North Carolina at Chapel Hill), 1990; Muki W. Fairchild, M.S.W. (North Carolina at Chapel Hill, 1976); Robert Fitch, M.D. (Duke, 1976); Allyn McConkie-Rosell, M.S.W. (Arkansas, 1980); Marcia Morgenlander, M.D. (Pittsburgh, 1988); William H. Schultz, P.A. (Duke, 1981); N. Maxine Soloway, M.S.W. (Nebraska, 1961), Ph.D. (North Carolina at Greensboro, 1985); A. William Taub, M.S.W. (North Carolina at Chapel Hill, 1981).

Associate Research Professor: David S. Millington, Ph.D. (Liverpool, England, 1969).

Assistant Research Professors: Donald Chace, Ph.D. (George Washington, 1989); Jia-Huan Ding, M.D. (Henan Med. Coll., 1970), Ph.D. (Peking Union Med. Coll., 1984); Michael D. Feezor, Ph.D. (North Carolina at Chapel Hill, 1969); J. Francis Heidlage, Ph.D. (Missouri, 1978); Nancy G. Henshaw, M.P.H. (North Carolina at Chapel Hill, 1981), Ph.D. (North Carolina at Chapel Hill, 1983); Cui-Wei Xie, Ph.D. (Beijing Med. Univ., 1984).

Research Associates: Ulus Atasoy, M.D. (Minnesota, 1984); Yong Bao, M.D. (Peking Union Med. Coll., 1986); Wasiuddin Khan, Ph.D. (Kanpur Univ., India, 1985); Hui-Ming Liu, M.D. (Norman Bethune Univ., 1978); Vojislav D. Miletic, Ph.D. (Belgrade, 1970); David D. Mott, Ph.D. (Duke, 1991); Mohamed A. Nada, Ph.D. (City Univ. of New York, 1992); Kasturi Puranam, Ph.D. (Indian Inst. of Science, 1988); Rashid N. Nassar, Ph.D. (Duke, 1974); Jianjun Shen, Ph.D. (Rutgers, 1992); Robert D. Stevens, Ph.D. (London, 1969); Ronald F. Thomas, Ph.D. (Miami, 1973); Jer-Yuarn Wu, M.D., Ph.D. (Duke, 1985); Bingzhi Yang, M.D. (Henan Med. Coll., 1968); Helen Yang, M.D. (Henan Med Coll., 1990).

Visiting Associates: Nan-Chang Chiu, M.D. (Kaohsiung Med. Col., 1984); Zumei Feng, M.D. (Henan, PRC, 1981); Toshihiko Iura, M.D. (Kanazawa Med. Univ., Japan, 1983), Ph.D. (Kanazawa Med. Univ., Japan, 1988); Ju-Li Lin, M.D. (China Med. Col., 1986).

Consulting Professors: Thomas K. Oliver, Jr., M.D. (Harvard, 1949); James A. Stockman III, M.D. (Jefferson, 1969).

Associate Consulting Professors: Rosalind Coleman, M.D. (Case Western Reserve, 1969); William L. London, M.D. (North Carolina at Chapel Hill, 1955); Howard H. Loughlin, M.D. (Pennsylvania, 1970); Evelyn Schmidt, M.D. (Duke, 1951), M.P.H. (Columbia, 1962).

Assistant Consulting Professors: Clarence A. Bailey, M.D. (North Carolina at Chapel Hill, 1958); James S. Hall, Jr., M.D. (Duke, 1957); Alvin H. Hartness, M.D. (Bowman Gray, 1965); Thomas M. McCutchen, Jr., M.D. (Vanderbilt, 1963); Charles B. Neal III, M.D. (Duke, 1955); John C. Pollard, M.D. (Virginia, 1968); William C. Powell, M.D. (Bowman Gray, 1952); Ann Reed, M.D. (Med. Coll. of Ohio, 1984); James B. Rouse, M.D. (Duke, 1965); Frank S. Shaw, M.D. (Pennsylvania, 1959); Charles I. Sheaffer, M.D. (Western Reserve, 1958); Leonard D. Stein, M.D. (Med. Coll. of Georgia, 1975); J. Gordon Still, M.D. (Bowman Gray, 1978), Ph.D. (Wake Forest, 1978); Fred R. Stowe, Jr., M.D. (North Carolina at Chapel Hill, 1958).

Consulting Associates: Lillis F. Altshuller, M.D. (Western Reserve, 1954); R. Meade Christian, Jr., M.D. (Western Reserve, 1967); Douglas W. Clark, M.D. (North Carolina at Chapel Hill, 1983); William G. Conley III, M.D. (Med. Coll. of Virginia, 1960); Jean M. Findlay, M.B., Ch.B. (Aberdeen Univ. Med. Sch., Scotland, 1970); Gregory A. Fisher, M.D. (South Florida, 1976); Martha E. Gagliano, M.D. (Duke, 1982); Keith Gallaher, M.D. (Pennsylvania State, 1982); Larry C. Harris, M.D. (Duke, 1977); Rufus McP. Herring, Jr., M.D. (Bowman Gray, 1969); Carl S. Hesselbart, M.S.W. (Michigan, 1980); Jennifer L. Lail, M.D. (Kentucky, 1978); Charles W. Lallier, M.D. (Virginia, 1981); Pierre C. LeMaster, M.D. (Florida, 1971); Donald N. Ludlow, Jr., M.D. (Hahnemann, 1983); Janice D. Stratton, M.D. (Tulane, 1961); Joseph W. Whatley, M.D. (Duke, 1958).

Emeriti: Jay M. Arena, M.D.; Edmond C. Bloch, M.B.; William Cleland, M.D.; Susan C. Dees, M.D.; Thomas E. Frothingham, M.D.; Jerome S. Harris, M.D.; Bailey D. Webb, M.D.

## Required Course

**PED-205C. Pediatrics.** The basic course in pediatrics for all students is an eight-week clerkship in the second year. Its principal aim is to provide an exposure to the field of child health. The student has a varying series of experiences which should give a grasp of the concepts that underlie the discipline. Goals should be to acquire familiarity and competence with the basic tools of information-gathering (history, physical examination, and laboratory data) and to develop an approach to the integration of this material for the solution of problems of health and illness in infancy, childhood, and adolescence. This should be accomplished with continuing reference to the basic principles of pathophysiology encountered in the first year courses.

Those patients to whom the student is assigned will provide the focus for case studies. In addition to the careful history and physical examination which must be recorded, the student is expected to organize an appropriate differential diagnosis and to seek and read pertinent reference material relevant to each patient. The student should learn to present each case verbally in an organized and succinct fashion, to follow the



patient's progress, and to interpret all studies which are performed. The student is expected to learn from a number of sources: standard textbooks and journals, current publications and conferences, and also from people—house staff, faculty, nurses, parents, and all others with whom contact is made in the clinical setting.

Objectives should also include an understanding of the roles played in pediatrics by other members of the health care team, both in the ambulatory and hospital settings. Patient care may include nurse, social worker, recreation therapist, psychologist, physiotherapist, dietitian, and others. The eight weeks will be divided to include time into several of the following settings: (a) Duke outpatient clinics and emergency room, (b) Duke inpatient, (c) Durham Regional Hospital, (d) Duke nursery, (e) Lincoln Community Health Center. Weight: 8. *Drucker*

**Electives**

**PED-210C. Advanced Pediatrics.** This course permits the student to elect an in-depth experience within pediatrics. Each student has a specific faculty preceptor who develops and implements the curriculum tailored to the individual's needs. Listed below are the faculty representatives to contact. Arrangements for the special topic should be made with these individuals prior to enrolling in the course. The name of the preceptor with whom a student is working must be noted on the registration card submitted to the Registrar's Office.

Division: Faculty	Telephone
Allergy/Immunology: Rebecca H. Buckley, M.D. ....	684-2922
Biochemical Genetics: Charles R. Roe, M.D. ....	549-0445
Cardiology: Arthur Garson, Jr., M.D., M.P.H. ....	681-2916
Critical Care Medicine: William J. Greeley, M.D. ....	681-3543
Emergency Department: Karen Frush, M.D.* ....	684-5537
Endocrinology: Michael S. Freemark, M.D. ....	684-3772
General Pediatrics: Deborah L. Squire, M.D. ....	477-4297
Poison Control: Shirley Osterhout, M.D. ....	684-4438
Hematology/Oncology: John M. Falletta, M.D. ....	684-3401
Infectious Diseases: Ross McKinney, M.D. ....	684-6335
Medical Genetics: Y. T. Chen, M.D., Ph.D. ....	684-2036
Nephrology: John W. Foreman, M.D. ....	684-4246
Neurology: Darrell Lewis, M.D. ....	684-3219
Perinatal Medicine: David T. Tanaka, M.D. ....	681-6024
Pulmonary: Thomas M. Murphy, M.D. ....	684-3364
Rheumatology: Deborah Kredich, M.D. ....	684-6575
Rural Health Clinics: Joanne Barton, Dr.P.H.+ ....	684-3172
Sports Medicine: Deborah Squire, M.D. ....	477-4297

\* The student participates in the initial evaluation, stabilization and management of pediatric medical and surgical patients in the emergency department. Special emphasis is placed on the approach to the pediatric trauma victim. Weekly didactic lectures and case review conferences are offered. The student is expected to research a relevant topic of his/her interest and lead a brief discussion with faculty and housestaff during the elective. The student is evaluated by the ED Attending staff and receives ongoing feedback throughout the rotation as well as a formal "exit interview."

+The Rural Health Clinics rotation provides a broad exposure to general pediatric problems in a medically indigent community. Four days a week (Monday through Thursday) the student travels with a senior pediatric resident to each of four rural county health departments to provide pediatric care in collaboration with public health nurses and child health clinicians. There is approximately two hours a day driving time, which allows for a one-on-one tutorial with the senior resident. The Special Topics course may vary from two to four weeks in length. Student may not drop within sixty days of the starting date without finding a replacement. Student must contact Dr. Barton three weeks before the course starting date. Weight: 1 to 8 Max: 1. *Osterhout and departmental division chiefs*

**PED-211C. Pediatric Infectious Diseases.** This course provides experience in the clinical and laboratory diagnosis of infectious diseases and in their therapy. The student works closely with the infectious disease fellow and participates actively in evaluation of patients. Daily rounds in microbiology laboratory. Participation in Monday infectious disease conferences are required. Prerequisites: contact Dr. McKinney prior to enrollment. Weight: 4 or 8 Max: 2. *Wilfert, McKinney, Gutman, Lehrman, Katz, Drucker, Walter, and Clements*

**PED-215C. Endocrine Disorders in Children.** Students attend in the Pediatric Endocrine, Diabetes, Neuroendocrine (Brain Tumor), and Bone and Mineral Clinics and assume active roles in the evaluation and management of inpatients admitted to the Endocrine Service. Emphasis is placed upon the evaluation of growth and sexual development as indices of endocrine status during childhood. Students also participate in a monthly endocrine journal club and in weekly intra- and inter- departmental endocrine clinical and research conferences. Prerequisite: contact instructors. Weight: 4 or 8 Max: 2. *Freemark, Morris, Friedman, Thrailkill, and Fowlkes*

**PED-217C. Pediatric Hematology and Oncology.** Includes all aspects of clinical and laboratory pediatric hematology as well as the diagnostic evaluation, care, and treatment of patients with malignant diseases. Emphasis is placed on fundamental concepts. There are daily ward rounds, five clinics weekly, conferences, and seminars as well as assigned reading. Prerequisites: contact instructor. Weight: 4 or 8 Max: 2. *Falletta, Kinney, Kurtzberg, Friedman, Laughlin, Longee, Ware, Saba, Graham, Casey, and Olson*

**PED-221C. Poison Control.** Primarily a seminar course with one, two-hour conference per week scheduled for student discussion on assigned topics. The student may participate in clinical functions of the Center and if desired may be on call for the treatment of these cases in the emergency room or the wards. This is a student-oriented teaching program and individual projects on the subject may also be carried out. Students must register for this course at least four weeks prior to the first day of class. Further, students must talk with Dr. Osterhout about the course at least one week before this same date. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Max: 4. *Osterhout*

**PED-225C. Neonatology.** Students have patient care responsibilities and experiences in the Duke North Intensive Care Nursery. The course involves direct participation in patient care under the supervision of the faculty and housestaff. Emphasis is placed on the initiation of parent-child relationships and a pathophysiologic approach to assessment and management of the critically ill neonate. Student may not drop within sixty days of the starting date without finding a replacement. This is a sole-enrollment course and, as such, cannot be taken in conjunction with any other course. Weight: 5 Max: 1. *Tanaka, Gingras, Goldstein, Auten, Iafolla, and Rosenblum*

**PED-231C. Clinical Pediatric Cardiology.** This course provides an intensive learning experience in the clinical diagnosis and management of childhood heart disease. Emphasis is placed upon the pre and post-operative management of children with operable heart disease as well as upon the management of children with non-operable heart disease. The student also is exposed to pediatric acute care medicine and the modalities available to maintain cardiovascular function in the extremely ill child. Scope: history, physical examination, and special diagnostic techniques (echocardiography, electrocardiography, phonocardiography, cardiac catheterization, and cineangiography). Students participate on daily ward rounds, outpatient clinics four days per week, and all clinical and didactic teaching conferences of the Division. Prerequisites: PED 205C. Weight: 4 (or 8 with special permission of the instructor) Max: 2. *Garson*

**PED-233C. Allergy and Clinical Immunology.** Clinical evaluation and practice in use of methods of diagnosis and treatment of allergic and immunologic disorders

including the atopic diseases, immunologic deficiency states, and bone marrow transplantation. Scope: in-depth seminars, history, physical examination, skin testing, a variety of clinical immunologic tests, and Clinical Research Unit experience. Weight: 4 or 8 Max: 3. *Buckley, Schiff, Markert, Williams, and Harville*

**PED-234C. Clinical Genetics and Metabolism.** The student becomes familiar with evaluation and management of various genetic disorders including malformation syndromes and biochemical disorders. History taking, pedigree construction and analysis, specialized aspects of the dysmorphological physical examination, diagnostic techniques, routine and specialized laboratory methods (cytogenetic, biochemical, molecular), and reference materials (texts and computer programs) are covered. Students participate in weekly teaching and clinical conferences and may take part in prenatal evaluations. May take with BCH-234B. Weight: 4 Max: 2. *Kahler*

**PED-241C. Pediatric Nephrology.** The course is designed to provide experience in diagnosis, interpretations of laboratory tests, natural history, and treatment of acute and chronic disorders of the kidney in children. The student is also exposed to the management of fluid and electrolyte disorders in infants and children. Prerequisites: PTH-362B suggested; prior approval of Dr. Wigfall. Weight: 4 Max: 1. *Foreman, McKay, and Wigfall*

**PED-243C. Adolescent Medicine.** Students participate in a weekly seminar with emphasis on the behavioral and developmental aspects of adolescence, drug abuse, sports medicine, and the pregnant teenager. Patient interactions are arranged in the Youth Clinic at the Duke General Pediatric Clinic on Monday afternoon and/or the Sports Medicine Clinic on Thursday afternoon. Tutorial and supervisory time to discuss specific patients and pertinent literature are arranged. Weight: 2 Max: 2. *Yancy, Squire, and Moses*

**PED-250C. Advanced General Pediatrics, Pediatric Intensive Care Unit.** This advanced course is designed to allow students a four week experience as a subintern in the Pediatric Intensive Care Unit. Under supervision of faculty attendings and resident housestaff, the senior student assumes primary responsibility for the care of critically ill children admitted to the Medicine and Surgery services in the Pediatric Intensive Care Unit. Emphasis is placed on the development of the pathophysiologic approach to the diagnosis and therapy of a broad spectrum of pediatric illnesses as they present in acute care settings. Advanced concepts in pediatric critical care are emphasized. Students rotate night call with resident pediatric housestaff. Prerequisite: PED-205C. Weight: 5 Min: 1 Max: 2. *Greeley, Kern, and Meliones*

**PED-260C. Advanced Clerkship in Pediatrics.** This course is designed to provide the student with an intensive, in-depth exposure to the diagnosis and management of pediatric patients hospitalized at Duke. Students are responsible for admission histories, physical examinations, and management throughout the hospitalization. The student serves as a subintern throughout the rotation. Night call is expected every fourth night. Weight: 5 Max: 2. *Kinney, Drucker, and faculty*

**PED-281C. Pediatric Neurology.** Students examine both hospitalized and ambulatory patients with neurological disorders. Emphasis is placed on the neurological history, examination, investigation and management techniques of nervous system disorders of infancy, childhood, and adolescence. Prerequisites: contact Dr. Lewis. Weight: 4 or 8 Max: 2. *Lewis*

## **ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS**

**PED-227C. Behavioral Aspects of Pediatrics**



# Pharmacology

Professor Anthony R. Means, Ph.D. (Texas at Austin, 1966), *Chairman*.

Professors: Mohamed Abou-Donia, Ph.D. (California at Berkeley, 1966); Everett H. Ellinwood, M.D. (North Carolina at Chapel Hill, 1959); Elliott Mills, Ph.D. (Columbia, 1964); Julian Victor Nadler, Ph.D. (Yale, 1964); Saul M. Schanberg, M.D. (Yale, 1964), Ph.D. (Yale, 1961); Theodore Slotkin, Ph.D. (Rochester, 1970); Harold C. Strauss, M.D., C.M. (McGill Univ., 1964); Gary Stiles, M.D. (Vanderbilt, 1975); Pelham Wilder, Ph.D. (Harvard, 1950).

Associate Professors: Cynthia M. Kuhn, Ph.D. (Duke, 1975); Elwood A. Linney, Ph.D. (California at San Diego, 1973); Donald McDonnell, Ph.D. (Baylor, 1987); James O. McNamara, Sr., M.D. (Michigan, 1968); Keith L. Parker, M.D., Ph.D. (Washington Univ., 1981); Rochelle D. Schwartz, Ph.D. (Georgetown, 1983); Shirish Shenolikar, Ph.D. (Univ. of Leeds, 1975); A. Richard Whorton, Ph.D. (Vanderbilt, 1975).

Assistant Professors: June S. Almenoff, M.D. (Mt. Sinai, 1985), Ph.D. (Mt. Sinai, 1983); Garth Bissett, Ph.D. (North Carolina State, 1982); Warner M. Burch, Jr., M.D. (Bowman Gray, 1971); Robert L. Fine, M.D. (Chicago, 1979); Robert T. Fremneau, Jr., Ph.D. (George Washington, 1985); Samuel E. George, M.D. (Washington Univ. 1980); Joseph Heitman, M.D. (Cornell, 1992), Ph.D. (Rockefeller, 1989); Homme W. Hellinga, Ph.D. (Cambridge Univ., 1986); Madan M. Kwatra, Ph.D. (Univ. of Montreal, 1977); Edward D. Levin, Ph.D. (Wisconsin, 1984); Tobias Myer, Ph.D. (Univ. of Basel, 1986); Ann Marie Pendergast, Ph.D. (California at Riverside, 1985); Kevin G. Peters, M.D. (Iowa, 1983); Debra A. Schwinn, M.D. (Stanford, 1983); Antonius VanDongen, Ph.D. (Univ. of Leiden, 1988); Xiao-Fan Wang, Ph.D. (California at Los Angeles, 1986).

Research Professors: Gertrude Elion, D.Sc. (George Washington, 1969); Wilkie A. Wilson, Jr., Ph.D. (Duke, 1971).

Associate Research Professor: Jorge Bartolome, Ph.D. (Univ. of Chile, 1978).

Assistant Research Professors: Donald L. Campbell, Ph.D. (Texas at Galveston, 1986); Ram Gupta, Ph.D. (Univ. of Delhi, 1982); Maxine Okazaki, Ph.D. (Univ. of Toronto, 1984); Frederic J. Seidler, Ph.D. (Duke, 1986).

Adjunct Professors: Robert Ferris, Ph.D. (Nebraska, 1967); Humberto Viveros, M.D. (Univ. of Chile, 1962); Joseph Yanai, Ph.D. (Univ. of Colorado, 1971).

Adjunct Associate Professors: Richard J. Kavlock, Ph.D., (Miami, 1977).

Adjunct Assistant Professors: Rochelle Hanley, M.D. (Michigan, 1978); Christopher Lau, Ph.D. (Duke, 1982); David Martin, Ph.D. (Univ. of London, 1987); Hernan A. Navarro, Ph.D. (Kentucky, 1987).

Emeritus: Norman Kirshner, Ph.D.; Leon Lack, Ph.D.; Athos Ottolenghi, M.D.

## Required Course

**PHR-200B. Pharmacology.** A basic course in pharmacology describing the action of drugs in terms of biochemical and physiological processes, and the rationale for their use in clinical therapy. Four lectures, one clinical correlation, and one conference per week. Weight: 4. *Nadler*

## Electives

**PHR-233B. Essentials of Pharmacology.** Drug absorption, distribution, excretion and metabolism; structure and activity relationships; drug and hormone receptors and target cell responses. C-L: Graduate School. Weight: 4 Min: 5 Max: 30. *Slotkin and staff*

**PHR-234B. Interdisciplinary Approach to Pharmacology.** Several model systems (cardiovascular, reproductive, neural, and cell cycle) are be used to explore the molecular, biochemical, and physiologic basis of drug action. CL: Graduate School. Weight: 3 Max: 20. *Shenolikar and staff*

**PHR-372B. Research in Pharmacology.** Laboratory investigation in various areas of pharmacology. C-L: Graduate School. Credit to be arranged. Weight: 1-16. *Staff*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

PHR-254B. Mammalian Toxicology

PHR-264B. Neurotoxicology

PHR-360B. Neuropharmacology

PHR-423B. Neurobiological Basis of Behavior

# Psychiatry

Professor Allen Frances, M.D. (Downstate Med. Center, 1967), *Chairman*.

## DIVISION OF BEHAVIORAL MEDICINE

Redford B. Williams, Jr., M.D., *Division Head*

Professors: Roy J. Mathew, M.B. (Medical College of Trivandrum, India, 1970); Redford B. Williams, Jr., M.D. (Yale, 1967).

Associate Professor: Valerie F. Holmes, M.D. (Louisville, 1980).

Assistant Clinical Professors: Indira M. Varia, M.D. (Shah Medical College, 1968); Michael R. Volow, M.D. (Seton Hall, 1964).

Clinical Associate: Lakshmi Kamaraju, M.D. (Andhra Univ., 1976).

Visiting Associate: Jane Tiller, M.B. (Glasgow Univ., 1986).

Research Associate: John Feaganes, Ph.D., Michael J. Helms.

## DIVISION OF BIOLOGICAL PSYCHIATRY

Ranga Krishnan, M.D., *Division Head*.

Professors: Everett H. Ellinwood, Jr., M.D. (North Carolina at Chapel Hill, 1959); C. William Erwin, M.D. (Texas, 1960); Saul M. Schanberg, M.D., Ph.D. (Yale, 1964); Theodore A. Slotkin, Ph.D. (Rochester, 1970); Richard Weiner, M.D., Ph.D. (Duke, 1973).

Consulting Professor: Richard J. Wyatt, M.D. (Johns Hopkins, 1964).

Adjunct Professor: Jau-Shyon Hong, Ph.D. (Kansas, 1973).

Associate Professors: Garth Bissette, Ph.D. (North Carolina State, 1982); K. Ranga Rama Krishnan, M.D. (Madras Med. Coll., 1978); Joseph P. McEvoy, M.D. (Vanderbilt, 1973).

Assistant Professors: Lawrence A. Dunn, M.D. (Michigan, 1984); Veeraindar Goli, M.D. (Osmania Med. Coll., 1978); Edward D. Levin, Ph.D. (Wisconsin, 1984); Scott D. Moore, M.D. (Virginia, 1986); Rochelle Schwartz, Ph.D. (Georgetown, 1983).

Assistant Clinical Professor: Stephen L. Oxley, M.D. (Kentucky, 1973).

Assistant Consulting Professor: Kumari Verghese, M.D. (Kastruba Med. Coll., 1972).

Associate Research Professor: Sheila Collins, Ph.D. (Massachusetts Inst. of Tech., 1985); Jed E. Rose, Ph.D. (California at San Diego, 1978).

Assistant Medical Research Professors: Tong H. Lee, M.D. (Stanford), Ph.D. (Duke, 1986); Syam Sundar, Ph.D. (India Inst. of Medical Services, 1978).

Associates: Leann Nelson, M.D. (Texas, 1986); Robert G. Ruegg, Jr., M.D. (Virginia, 1970).

Clinical Associate: Joseph Balla, M.D. (Illinois, 1988); Christopher Byrum, M.D. (Virginia, 1988); Marian Butterfield, M.D. (North Carolina at Greensboro, 1990); Frederick Cassidy, M.D. (Vanderbilt, 1988); Ursula Goebels, M.A. (Illinois, 1983); Lawrence Katz, M.D. (Missouri, Columbia, 1988); David C. Steffens, M.D. (Texas, 1988).

Consulting Associates: Byron Cole, M.D. (Cincinnati, 1960); Ugo Goetzl, M.D. (New York Med. Coll., 1968); Allen Hamrick, M.D. (North Carolina at Chapel Hill, 1987); Thu Van Thai, M.D. (Saigon, 1970).

Adjunct Associate: Richard Weisler, M.D. (North Carolina at Chapel Hill, 1976).

Research Associates: Shiyang Wang, Ph.D. (North Carolina State Univ., 1992).

## DIVISION OF CHILD AND ADOLESCENT PSYCHIATRY

Allan Chrisman, M.D., *Division Head*.

Professor: John G. Looney, M.D. (Southwestern, 1969).

Visiting Research Professor: Robert Coles, M.D. (Columbia, 1954).

Associate Professors: J. David Jones, M.D. (Duke, 1954); Charles R. Keith, M.D. (Harvard, 1961).

Associate Clinical Professor: W. Samuel Yancy, M.D. (Duke, 1961).

Associate Consulting Professor: Edgar P. Nace, M.D. (Wisconsin, 1966).

Assistant Professors: Marcelino Amaya, M.D. (Univ. Nacional Autonoma de Mexico, 1954); Lisa Amaya-Jackson, M.D. (North Carolina at Chapel Hill, 1986); Adrian C. Angold, BSc (London Hospital Medical School, 1976); James E. Lee, M.D. (Duke, 1979); John S. March, M.D. (California at Los Angeles, 1978).

Assistant Clinical Professor: Allan Chrisman, M.D. (George Washington Univ., 1971); Karl Stevenson, M.D. (Bowman Gray, 1966).

Assistant Research Professors: Alaattin Erkanli, Ph.D. (Carnegie Mellon, 1991).

Assistant Consulting Professors: Cesar Guajardo, M.D. (Univ. de Nuevo Leon, Mexico, 1961); Aglaia N. O'Quinn, M.D. (Duke, 1965); James B. Payton, M.D. (Arkansas, 1971); Ingrid Pisetsky, M.D. (Albert Einstein, 1971); Raymond F. Schmitt, Jr., M.D. (Louisiana, 1959).

Associates: Carole R. Dunmire, M.D., Ph.D. (Rush, 1985).

Clinical Associates: Lucy T. Davis, Ed.D. (Columbia, 1955); Ranota D.T. Hall, M.D. (East Tennessee State, 1987); Paul D. Nagy, M.S. (Florida State, 1984); Carol J. Vander-Zwaag, M.D. (Mount Sinai, 1986).

Consulting Associates: Peter F. Adland, M.D. (Georgetown, 1975); Linwood R. Allsbrook, M.D. (Kentucky, 1981); Thomas C. Cornwall, M.D. (Northwestern, 1970); Bonny Gregory, M.D. (Med. Coll. of Georgia, 1978); Bryon Herbel, M.D. (North Dakota, 1986); D. Randall Johnson, M.D. (South Carolina, 1983); Nancy J. Livingston, M.D. (Duke, 1972); William Mackey, M.D. (Tennessee, 1969); Vladimir Maletic, M.D. (Univ. Belgrade, 1981); Jane L. Pope, M.D. (Louisville, 1972); Margaret A. Shugart, M.D. (Med. Coll.



of Virginia, 1984); Elizabeth S. Stanton, M.D. (Mississippi, 1982); Daphne Rosenblitt, M.D. (Duke, 1974); Donald L. Rosenblitt, M.D. (Duke, 1973); David A. Smith, M.D. (Alabama, 1980).

Adjunct Associate: Jean G. Spaulding, M.D. (Duke, 1972).

Instructors: Barbara J. Smith, M.Ed. (North Carolina Central, 1983).

## **DIVISION OF GENERAL PSYCHIATRY**

Jesse O. Cavenar, Jr., M.D., *Division Head*.

Professors: Jesse O. Cavenar, Jr., M.D. (Arkansas, 1963); Frederick R. Hine, M.D. (Yale, 1949);

Associate Professor: Jean Hamilton, M.D. (Univ. Texas, 1977).

Associate Clinical Professor: Steven Lipper, M.D. (Boston, 1972); Harold Silberman, M.D. (Washington, 1956).

Associate Consulting Professors: Pedro J. Irigaray, M.D. (Univ. Nacional Autonoma de Mexico, 1955).

Assistant Professors: Elliott B. Hammett, M.D. (Duke, 1966); Kenneth W. J. Rockwell, M.D. (Duke, 1961).

Assistant Clinical Professors: Conrad C. Fulkerson, M.D. (Missouri, 1969); Harold S. Kudler, M.D. (State Univ. of New York, 1979).

Assistant Consulting Professors: Christine Machemer, M.D. (Freiburg, 1959); Ervin Thompson, M.D. (Vanderbilt, 1972).

Associates: Rosa F. Merino, M.D. (Case Western Reserve, 1985); Linda Roy M. Stein, M.D. (Duke, 1980).

Clinical Associates: Katherine Enright, M.D. (Duke, 1985); Elizabeth King, M.D. (Duke, 1958); Linda R. Mitchell, B.S. (Campbell, 1968); Linda H. Rubin, M.P.H. (North Carolina at Chapel Hill, 1978); Robert E. Winton, M.D. (Vanderbilt, 1972).

Consulting Associates: Jeffrey R. Chambers, M.D. (Michigan, 1986); Philip Hillsman, M.D. (Tennessee, Memphis, 1987); Rose Shalom, M.D. (Harvard, 1978); Jonathan Weiner, M.D. (North Carolina at Chapel Hill, 1987).

## **DIVISION OF GERIATRIC PSYCHIATRY**

John C.S. Breitner, M.D., M.P.H., *Division Head*.

Professors: J. P. Gibbons Professor Dan G. Blazer, M.D. (Tennessee, 1969), Ph.D. (North Carolina at Chapel Hill, 1980); Bernard J. Carroll, M.B. (Melbourne, 1964), Ph.D. (Melbourne, 1971); Daniel T. Gianturco, M.D. (Buffalo, 1960).

Associate Professor: John C.S. Breitner, M.D., M.P.H. (Pennsylvania, 1970).

Assistant Professor: Harold G. Koenig, M.D. (California at San Francisco, 1982).

Assistant Research Professor: Judith C. Hays, R.N., Ph.D. (Yale, 1991).

Clinical Associates: Sharon M. Wallsten, B.S.N., M.P.H. (Michigan, 1965).

Consulting Associates: Andree Allen, M.D. (Miami, 1982); Leslie Hocking, M.D. (Tufts Univ., 1983).

Research Associate: Bruce Burchett, Ph.D. (Carleton, 1983).

Research Assistant: Nancy E. Fowler, M.Ed. (North Carolina at Chapel Hill, 1971).

Instructor: Cornelia B. Service, M.P.H. (North Carolina at Chapel Hill, 1979).

## **DIVISION OF MEDICAL PSYCHOLOGY**

Robert J. Thompson, Ph.D., *Division Head*.

Professors: Irving Alexander, Ph.D. (Princeton, 1949); James A. Blumenthal, Ph.D. (Washington, 1975); Barbara J. Burns, Ph.D. (Boston, 1972); Robert Carson, Ph.D. (Northwestern, 1957); C. Keith Conners, Ph.D. (Harvard, 1960); W. Edward Craighead, Ph.D. (Illinois, 1970); Herbert Crovitz, Ph.D. (Duke, 1970); Martin Lakin, Ph.D. (Chicago, 1955); Susan Roth, Ph.D. (Northwestern Univ., 1973); Susan Schiffman, Ph.D. (Duke, 1970); S. Richard Surwit, Ph.D. (McGill, 1972); Robert J. Thompson, Ph.D. (North Dakota, 1971).

Adjunct Professors: Florence Kaslow, Ph.D. (Bryn Mawr, 1969); Rune Simeonsson, Ph.D. (George Peabody, 1971).

Associate Professors: Norman B. Anderson, Ph.D. (North Carolina at Greensboro, 1983); Elizabeth J. Costello, Ph.D. (Univ. London, 1981); Elaine K. Crovitz, Ph.D. (Duke, 1964); John F. Curry, Ph.D. (Catholic, 1978); Karen M. Gil, Ph.D. (West Virginia, 1985); Francis J. Keefe, Ph.D. (Ohio, 1975); John E. Lochman, Ph.D. (Connecticut, 1976); Patrick E. Logue, Ph.D. (North Dakota, 1965); Gail Marsh, Ph.D. (Iowa, 1968); Andrew Sherwood, Ph.D. (Univ. Hull, England); Robert Shipley, Ph.D. (Michigan State, 1972); W. Derek Shows, Ph.D. (Duke, 1967); Ilene C. Siegler, Ph.D. (Syracuse, 1973); Karen C. Wells, Ph.D. (Georgia, 1978); William H. Wilson, Ph.D. (Vanderbilt, 1973).

Associate Clinical Professors: Jack D. Edinger, Ph.D. (Virginia Commonwealth, 1971); Rolffs S. Pinkerton, Ph.D. (Georgia, 1967); Anna L. Stout, Ph.D. (South Carolina, 1980); Scott Swartzwelder, Ph.D. (The American Univ., 1980).

Adjunct Associate Professors: Paul T. Costa, Jr., Ph.D. (Chicago, 1970); John A. Fairbank, Ph.D. (Auburn, 1980).

Associate Consulting Professors: Lenore Behar, Ph.D. (Duke, 1973); Paul Brinich, Ph.D. (Univ. Chicago, 1974).

Associate Research Professors: John C. Barefoot, Ph.D. (North Carolina at Chapel Hill, 1968); Gerda G. Fillenbaum, Ph.D. (London, 1956); David J. Madden, Ph.D. (California at Davis, 1977).



Assistant Professor: Brian Esterling, Ph.D. (Univ. Miami, 1991).  
Kathryn Gustafson, Ph.D. (Ohio, 1988); Barbara R. Keith, Ph.D. (Alabama, 1992); Karen O'Donnell, Ph.D. (North Carolina at Chapel Hill, 1983); Clive J. Robins, Ph.D. (SUNY, 1982); Edward C. Suarez, Ph.D. (Miami, 1986); Kathleen A. Welsh, Ph.D. (Virginia, 1985).

Assistant Clinical Professors: John Barrow, Ph.D. (Houston, 1971); Jean C. Beckham, Ph.D. (Florida State, 1988); Tracey Potts Carson, Ph.D. (Georgia, 1982); Drew D. Erhardt, Ph.D. (UCLA, 1991); Mark Feinglos, M.D. (McGill, 1973); Susan Head, Ph.D. (Louisiana State Univ., 1991); Steve Herman, Ph.D. (Duke, 1977); Martin Ionescu-Pioggia, Ph.D. (North Carolina at Chapel Hill, 1985); Ronette L. Kolotkin, Ph.D. (Minnesota, 1978); Albert D. Loro, Jr., Ph.D. (Washington, 1976); Richard Lucas, Ph.D. (North Carolina at Chapel Hill, 1972); Laura M. Mann, Ph.D. (Missouri at Columbia, 1987); Jerri M. Oehler, Ph.D. (Duke, 1984); Ann C. Schulte, Ph.D. (Texas, 1983); James L. Spira, Ph.D. (California at Berkeley, 1991); Gail A. Spiridigliozzi, Ph.D. (Kansas, 1988); Craig R. Stenberg, Ph.D. (Denver, 1982); Joseph E. Talley, Ph.D. (Virginia, 1977).

Assistant Research Professors: Emily Arcia, Ph.D. (North Carolina at Chapel Hill, 1988); George R. King, Ph.D. (New York at Stony Brook, 1989); Maya R. McNeilly, Ph.D. (Georgia, 1987); H. Ryan Wagner, Ph.D. (New Mexico, 1975).

Adjunct Assistant Professors: Ralph Cooper, Ph.D. (Rutgers, 1973); James A. Green, Ph.D. (North Carolina at Chapel Hill, 1979).

Adjunct Assistant Research Professor: Sandra Funk, Ph.D. (North Carolina at Chapel Hill, 1976).

Assistant Consulting Professors: William D. Barley, Ph.D. (Texas Tech., 1980); Randy Borum, Ph.D. (Florida, 1992); William V. Burlingame, Ph.D. (Univ. Washington, 1967); Roni Cohen, Ph.D. (Columbia, 1977); Rodney Lowman, Ph.D. (Michigan State, 1979); Richard L. Munger, Ph.D. (Michigan, 1979).

Associates: Kathleen Wayland, Ph.D. (Duke, 1989).

Clinical Associates: Linda Barnett, Ph.D. (Kentucky, 1981); Pat Beaupre, Ph.D. (Washington Univ., 1993); Loretta E. Braxton, Ph.D. (North Carolina at Chapel Hill, 1989); Susanne E. Dunn, Ph.D. (Duke, 1989); Jennifer Edens, Ph.D. (West Virginia, 1993); Jeff Epstein, Ph.D. (Univ. South Carolina, 1994); William B. Gunn, Jr., Ph.D. (James Madison, 1986); Pamela S. Hazlett, Ph.D. (North Carolina at Chapel Hill, 1991); Lisa Lenhart, Ph.D. (North Carolina at Greensboro, 1992); Robert Mankoff, Ph.D. (Georgia State, 1992); Terry T. McCandies, Ph.D. (North Carolina at Greensboro, 1993); Patricia Merriman, Ph.D. (Ohio State, 1974); Shari Miller-Johnson, Ph.D. (Virginia, 1991); Michael Murray, Ph.D. (South Florida, 1993); Oliver Oyama, Ph.D. (Indiana, 1985); Richard R. Rumer, Ph.D. (North Carolina at Chapel Hill, 1982); Rebecca Schein, Ph.D. (Fairleigh Dickinson, 1992); Elizabeth Schumacher, Ph.D. (Univ. Iowa, 1993); Gregory Thwaites, Ph.D. (Colorado State, 1993); Larry A. Tupler, Ph.D. (Emory, 1989); Jennifer Wilson, Ph.D. (Univ. Alabama, 1994).

Adjunct Associates: Juesta M. Caddell, Ph.D. (Virginia Polytechnic Inst, 1991); Mareah Steketee, Ph.D. (California School of Professional Psychology, 1992).

Consulting Associates: Steven J. Ashby, Ph.D. (Connecticut, 1976); Spencer Lylerly, Ph.D. (North Carolina State Univ., 1987).

Instructors: John T. Edwards, Ph.D. (Georgia, 1977); Joseph Kertesz, M.A. (Michigan, 1973).

Research Associates: Miriam Clifford, Ph.D. (Duke, 1970); Craig R. Colder, Ph.D. (Arizona State, 1994); Thomas Haney, M.S.P.H. (North Carolina at Chapel Hill, 1978).

## **DIVISION OF OUTPATIENT SERVICES**

Jonathan R.T. Davidson, *Division Head*.

Professor: H. Keith H. Brodie, M.D. (Columbia, 1965); Jonathan R.T. Davidson, M.D. (University College, London, 1966).

Associate Consulting Professors: Joseph DeVeauigh-Geiss, M.D. (SUNY-Upstate, 1972); David M. Hawkins, M.D. (Duke, 1966); Alan Metz, M.B.B.Ch (Univ. Witwaterstand, South Africa, 1978).

Assistant Professor: Stephen Ford, M.D. (East Tennessee State, 1980); Tana A. Grady, M.D. (Duke, 1986); Andrew Krystal, M.D. (Duke, 1987).

Assistant Clinical Professors: Leslie M. Forman, M.D. (Tufts, 1972); Kishore Gadde, M.D. (Guntur Medical College, 1978); Patricia A. Ziel, M.D. (Michigan, 1968).

Assistant Consulting Professors: Jack W. Bonner, III, M.D. (Southwestern, 1965); Stephen Buie, M.D. (North Carolina at Chapel Hill, 1981); Martin G. Groder, M.D. (Columbia, 1964); Linda H. Jackson, M.D. (North Carolina at Chapel Hill, 1965); Eric Peterson, M.D. (Duke, 1971); Robert D. Phillips, M.D. (Pennsylvania, 1952); Leo Potts, M.D. (Adelaide, 1954); Richard Selman, M.D. (Emory, 1972); Cynia B. Shimm, M.D. (Yale, 1950); Robert M. Wells, M.D. (Tulane, 1954).

Clinical Associate: Eileen P. Ahearn, M.D. (duke, 1990); Barbara A. Johnson, M.D. (Univ. Minnesota, 1991); Mark McGee, M.D. (Ohio State, 1989); David F. Naftolowitz, M.D. (Albany Medical Center, 1986); Mary S. Soderstrom, M.D. (Texas Southwestern, 1990); Suzanne Sutherland, M.D. (Michigan State, 1988); Susan Wicke, M.D. (Ohio State, 1989).

Associates: Lou Ann Crume, M.D. (Kentucky, 1986); Caroline Haynes, M.D., Ph.D. (Duke, 1983); Theresa A. Yuschok, M.D. (Northwestern, 1986).

Consulting Associates: John A. Ascher, M.D. (North Carolina at Chapel Hill, 1980); Ernest R. Braasch, M.D. (SUNY, 1970); Lawrence Champion, M.D. (Wisconsin, 1973); Lida M. Jeck, M.D. (Duke, 1977); Duncan McEwen, M.D. (Tulane, 1982); Rex Moody, M.D. (North Carolina at Chapel Hill, 1987); Mindy Oshrain, M.D. (Duke, 1983); Peter Z. Perault, M.D. (Vermont, 1977); Roger Perilstein, M.D. (Temple, 1982); Ernest Raba, M.D. (Texas, 1972); Kathleen Seibel, M.D. (Minnesota, 1985); Philip M. Spiro,

M.D. (Yale, 1983); Nathan R. Strahl, M.D. (North Carolina at Chapel Hill, 1983); David M. Susco, M.D. (Pennsylvania, 1983); Ronald L. Vereen, M.D. (Duke, 1981); Patricia Webster, M.S.N. (North Carolina at Chapel Hill, 1976); James R. Weiss, M.D. (Louisiana, 1973); James S. Wells, Jr., M.D. (North Carolina at Chapel Hill, 1977); Floyd C. Weisman, M.D. (Texas at Houston, 1982).

Instructors: Elizabeth Nicholes, P.A.C. (Duke, 1979); Thomas Stephenson, M.D. (Michigan, 1972).

Research Associates: James R. Bachar, Ph.D. (Univ. Pittsburgh).

## **DIVISION OF PSYCHIATRIC SOCIAL WORK**

Muki Fairchild, M.S.W., *Division Head*.

Assistant Professors: Lisa Gwyther, M.S.W. (Case Western Reserve, 1969).

Clinical Assistant Professors: Brenda Jo Kurz, Ph.D. (North Carolina at Chapel Hill, 1986); William S. Meyer, M.S.W. (Illinois, 1977); Jane Clark Moorman, MSW (Tulane, 1971).

Consulting Assistant Professor: William G. Saur, M.S.W., Ph.D. (Florida State, 1980).

Associates: Maxine R. Flowers, M.S.W. (Columbia, 1964); Muki Fairchild, M.S.W. (North Carolina at Chapel Hill, 1976); Edward Lueth, M.S.W. (North Carolina at Chapel Hill, 1982); Patricia Meadows, MSW (Cincinnati, 1979); Diane E. Meglin, M.S.W. (Yeshiva, 1982).

Clinical Associates: Camille S. Arrington, M.S.W. (North Carolina at Chapel Hill, 1982); Edna M. Ballard, M.S.W. (North Carolina at Chapel Hill, 1980); Barbara A. Gau, M.S.W. (North Carolina at Chapel Hill, 1986); M. Jane Howard, M.S.W. (Texas, 1979); Gael McCarthy, M.S.W. (North Carolina at Chapel Hill, 1985); S. Kay Patterson, M.S.W. (Ohio State, 1967); Peter Perlman, M.S.W. (North Carolina at Chapel Hill, 1982); Andrew Silberman, M.S.W. (North Carolina at Chapel Hill, 1982); Libby E. Webb, MSW (Indiana, 1980).

Consulting Associates: Bess Autry, M.S.W. (North Carolina at Chapel Hill, 1976); Mary Ann Black, M.S.W. (North Carolina at Chapel Hill, 1970); Natalie R. Boorman, M.S.W. (North Carolina at Chapel Hill, 1983); Mary Jane Burns, MSW (North Carolina at Chapel Hill, 1974); Renate P. Guttman, M.S.W. (North Carolina at Chapel Hill, 1969); Stephen Hawthorne, M.S.W. (California, 1974); Debbie Hill, MSW (North Carolina at Chapel Hill, 1987); Mary Gail Holton, M.S.W. (Richmond Professional Inst., 1966); Herbert Klar, M.S.W. (Smith College of S.W., 1977); Lois P. Minis, M.S.W. (North Carolina at Chapel Hill, 1981); Betty B. Parham, M.S.W. (Smith, 1971); Anne K. Parrish, M.S.W. (North Carolina at Chapel Hill, 1963); Joye Pursell, M.S.W. (North Carolina at Chapel Hill, 1978); Carolyn Thornton, M.S.W. (North Carolina at Chapel Hill, 1968); Timothy C. Wackerhagen, M.S.W. (South Carolina, 1986); Stella Waugh, MSW (North Carolina at Chapel Hill, 1986); Elinor T. Williams, MSW (North Carolina at Chapel Hill, 1977); Margaret Wilner, M.S.W. (Columbia, 1977).

Instructors: Marilyn Feinberg Bara, MSW (North Carolina at Chapel Hill, 1990); Christine Bell, M.S.W. (North Carolina at Chapel Hill, 1977); Nan T. Birchall, M.S.W. (Pennsylvania, 1979); Mary Sue Cherney, M.S.W. (North Carolina at Chapel Hill, 1983); Gary Cunha, MSW (East Carolina, 1992); James Dolan, M.S.W. (Rutgers, 1981); Eugene B. Glenn, Jr., M.S.W. (North Carolina at Chapel Hill, 1981); Judith Herman, M.S.W. (North Carolina at Chapel Hill, 1983); Bohdan Hrynewych, M.S.W. (Catholic, 1987); Julia B. Johnston, MSW (North Carolina at Chapel Hill, 1989); Meryl Kanfer, MSW (Univ. Pennsylvania, 1994); Karl K. Kanoy, M.S.W. (Atlanta School of Social Work, 1979); Cedar Koons, MSW (North Carolina at Chapel Hill, 1993); Robert Laws, M.S.W. (North Carolina at Chapel Hill, 1978); John McLain, M.S.W. (North Carolina at Chapel Hill); Ylana N. Miller, Ph.D. (California at Berkeley, 1975); Patrick J. Murphy, M.S.W. (Our Lady of the Lake, 1974); Maureen Murray, M.S.W. (Smith College, 1986); Arianne Palmer, MSW (North Carolina at Chapel Hill, 1992); Twyla J. Peterson, M.S.W. (North Carolina at Chapel Hill, 1985); Marilyn D. Reedy, M.S.W. (Tulane, 1964); Susan Sweney, M.S.W. (North Carolina at Chapel Hill, 1986); Mickey Tullar, M.S.W. (North Carolina at Chapel Hill, 1982); Jean Whicker, M.S.W. (North Carolina at Chapel Hill, 1990); Bobby Williamson, M.S.W. (Michigan State, 1979); Ann S. Willoughby, M.S.W. (North Carolina at Chapel Hill, 1988); Nancy B. Winer, M.S.W. (North Carolina at Chapel Hill, 1990); Mary Ann Zabrycki, M.S.W. (Illinois, 1980).

## **DIVISION OF SOCIAL AND COMMUNITY PSYCHIATRY**

Marvin S. Swartz, M.D., *Division Head*

Professors: Kurt Back, Ph.D. (MIT, 1949); James H. Carter, M.D. (Howard, 1966); Linda K. George, Ph.D. (Duke, 1975); George L. Maddox, Ph.D. (Michigan, 1956).

Associate Professors: Jacquelyne J. Jackson, Ph.D. (Ohio State, 1960); Marvin S. Swartz, M.D. (Tufts, 1980).

Associate Consulting Professor: Nicholas Stratas, M.D. (Toronto, 1957).

Assistant Professors: Deborah T. Gold, Ph.D. (Northwestern, 1986); Dan L. Tweed, Ph.D. (Iowa State, 1975).

Adjunct Associate Professor: David B. Larson, M.D. (Temple, 1973).

Assistant Clinical Professor: Thomas E. Sibert, M.D. (Baylor, 1983).

Assistant Consulting Professor: Sally Johnson, M.D. (Jefferson, 1976); Kathryn Magruder-Habib, MPH, Ph.D. (North Carolina at Chapel Hill, 1978).

Adjunct Assistant Professor: Keith G. Meador, M.D. (Louisville, 1982).

Assistant Research Professors: Elizabeth Farmer, Ph.D. (Duke, 1991); L. Richard Landerman, Ph.D. (Duke, 1978); Jeffrey W. Swanson, Ph.D. (Yale, 1985).



Clinical Associates: Terry Ainsworth, M.S. (Univ. Maryland, 1981); Lucile D. Clotfelter, M.D. (North Carolina at Chapel Hill, 1986); James N. Finch, M.D. (South Florida, 1981); Carol Saur, MSN (America School of Nursing, 1965); Lindsey Tweed, M.D. (Duke, 1987).

Consulting Associates: B. Steven Bentsen, M.D. (Cincinnati, 1983); Bruce A. Berger, M.D. (Minnesota, 1977); Jeffrey Brantley, M.D. (North Carolina at Chapel Hill, 1977); Eugene A. Douglas, M.D. (North Carolina at Chapel Hill, 1959); Amilda Horne, M.D. (Univ. Texas, 1979); Gordon Lavin, M.D. (Case Western Reserve, 1978); Thomas D. Owens, M.D. (Louisiana, 1985); Mark S. Reynolds, M.D. (Tulane, 1983); James A. Smith, III, M.D. (Howard, 1976); John G. Wagnitz, M.D. (Ohio State, 1971).

Adjunct Associates: Mary Lou Melville, M.D. (Texas, 1971).

Associate in Research: Sandra C. Leak, M.A. (Duke, 1979).

Lecturers: Robert Rollins, M.D. (Duke, 1956); N.P. Zarzar, M.D. (American University, Beirut, 1956).

Emeriti: William B. Anderson, M.D.; Marie Baldwin, M.D.; Marianne Breslin, M.D.; Ewald W. Busse, M.D.; Edward Clifford, M.D.; Hallie Coppedge, M.S.W.; Bingham Dai, Ph.D.; John A. Fowler, M.D.; Robert L. Green, M.D.; Mary M. Huse, Ph.D.; Erdman Palmore, Ph.D.; Joseph B. Parker, M.D.; John M. Rhoads, M.D.; Hsio-Shan Wang, M.D.; David S. Werman, M.D.; Martha L. Wertz, M.S.W.; Alan Whanger, M.D.; William P. Wilson, M.D.

## Required Courses

**PSC-200B. Human Behavior.** Consists of fifty-five hours. Students will learn about the neurobiological, psychological, and social determinants of behaviors that they can expect to encounter in their patients. The course begins with some general background information about normal development and the interaction of personality style and illness, and continues with the consideration of specific human behaviors, both normal and abnormal. The course concludes with a section on techniques for modifying human behavior. Small group sessions, which meet weekly, have an emphasis on learning interviewing techniques with live patients, and on developing an appreciation for personality and behavioral factors resulting from and impacting on these patients' illnesses. Weight: 2. *Haynes*

**PSC-205C. Psychiatry.** This course is a required six-week clerkship in clinical psychiatry for second year medical students. Students assume limited responsibility with supervision for the diagnosis and treatment of patients with common and severe psychiatric illnesses. Educational settings include inpatient psychiatry services at four different hospitals, psychiatry outpatient clinics, and the psychiatry emergency rooms of two hospitals. Students participate in a series of core didactic lectures and didactic modules which expose them to basic psychopathologic entities, differential diagnosis of psychiatric symptoms, practical application of treatment modalities, and issues of cost effectiveness in diagnosis and treatment. Students also participate in lectures, rounds, and clinical case conferences particular to their rotation site. Students are encouraged to observe psychotherapy and to participate in supervised psychological treatments wherever appropriate opportunities can be provided. Weight: 8. *Haynes*

## Basic Science Electives

**PSC-213B. Human Development: Birth-Adolescence.** This course is a survey of the psychological development of the child from birth through adolescence. The first segment of the course is designed to provide the student with an awareness of some of the major theoretical orientations to child development including the psychoanalytic, Piagetian, and social learning positions. This is followed by a systematic study of the normal sequence of child development, focusing in particular on some of the major events in the cognitive, social, and emotional life of the child. The course is run in seminar fashion utilizing numerous theoretical and research papers as well as observation of children in naturalistic settings to facilitate class discussion. Students also are required to familiarize themselves with research in child development by doing a review of the literature in a defined area. Weight: 2 Min: 1. *Curry*

**PSC-223B. Neurobiological Basis of Behavior.** The course surveys neuroanatomical, neurophysiological, neurochemical and neuropharmacological evidence of central nervous system function as it relates to normal and abnormal behavior. Clinical descrip-



tion, measurements of function and laboratory models of function as well as the biological substrates of affective disorders and psychoses are emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, are examined. Course format consists of assigned readings, study questions, and lectures by faculty and other active researchers. Mid-term and final examinations are given. Each student is expected to critique a circumscribed area of research literature focusing on the appropriateness of conceptualizations and experimental methods. Additionally, students have an opportunity to become acquainted with, and to participate in, ongoing research. Weight: 4 Min: 1. *Ellinwood*

**PSC-297B. Ethnic and Minority Health Patterns and Problems.** Descriptive and analytical focus on the literature about ethnic and minority health patterns in the United States, the issues inherent therein, and the implications thereof for the delivery of medical services. Weight: 4 Min: 1. *Carter*

**PSC-299B. Preceptorship in Behavioral Neurosciences.** This course provides an opportunity for the student to work closely with a member of the faculty in an area of mutual interest with emphasis upon research (see the booklet, *Basic Science Elective Program for Students in the Third Year Behavioral Neurosciences*, Study Program section, for partial list of interest areas; more complete descriptions available). Weight: 1-16. *Ellinwood*

### **Clinical Science Electives**

Clinical courses offered through the Department of Psychiatry are grouped in different subject categories. These categories, and the courses within each, are shown below. General questions regarding any of the clinical rotations should be referred to Caroline Haynes, M.D., director of medical student education (684-6406).

#### *Child Psychiatry*

Designed as preparation for students interested in pediatrics. Interested students should contact Charles Keith, M.D., director of education, Division of Child Psychiatry, 286-4456 or 684-3044.

227C. Behavioral Aspects of Pediatrics

#### *Community Psychiatry*

Designed for students interested in family practice, internal medicine, and adult psychiatry. Interested students should contact Dan L. Tweed, M.D., Division of Social and Community Psychiatry, 684-5274.

251C. Community Psychiatry

#### *Forensic Psychiatry*

Designed for students interested in adult and child psychiatry. Interested students should contact James Carter, M.D., 684-6102.

353C. Correctional/Forensic Psychiatry—Adult and Adolescent

#### *Individual Psychotherapy*

Designed for students interested in family practice, internal medicine, adult and child psychiatry. Interested students should contact David Werman, M.D., 684-6605.

280C. Modern Psychotherapy I: Intensive Clinical Introduction

281C. Modern Psychotherapy II: Extended Psychotherapy Experience

#### *Management of Adult Psychiatric Inpatients*

These courses are listed as preparation for students interested in adult psychiatry, family practice, internal medicine, surgery, and obstetrics and gynecology. Students

interested in these courses should contact Dr. Caroline Haynes, M.D., director of medical student education, 684-6406.

240C. Subinternship in Psychiatry

335C. Research Preceptorship in Clinical Psychiatry

### *Neuropsychiatry*

Designed for students interested family practice, internal medicine, and adult psychiatry. Interested students should contact Rich Weiner, M.D., Ph.D., director of electroconvulsive service.

260C. Neuropsychiatry

275C. Assessment of Sleep Disorders and Treatment

### *Psychosomatic Medicine*

Designed as preparation for students interested in family practice, internal medicine, surgery, obstetrics and gynecology, and adult psychiatry. Students interested should contact either Indu Varia, M.D., director, Consultation/Liaison Service, 684-4336, at Duke or Mike Volow, M.D. at the VA Hospital, 286-0411.

245C. Psychosomatic Medicine

### *Substance Abuse*

Designed for students interested in family practice, internal medicine, and adult psychiatry. Interested students should contact Roy Mathew, M.D., director, Duke Alcohol and Addictions Program, 684-6857 or Roy Stein, M.D., director, Veterans Administration, 286-0411.

343C. Clinical Aspects of Alcohol and Drug Abuse

## **Course Descriptions**

**PSC-240C. Subinternship in Psychiatry.** This course is an intensive clinical experience in the diagnosis and treatment of severe and incapacitating psychiatric disorders. The student is given more clinical responsibility than the comparable second year inpatient rotation. Patient care responsibilities include management of ward milieu. Treatment approaches emphasizing psychotropic medication, individual, family, and group psychotherapy are part of the clinical experience. Participation at selected patient care conferences and didactic lectures is expected. The rotation is available at Duke and the VA. The rotation at the VA includes admission decision-making. At Duke, specialty program experience is available. This experience can be structured to include a survey of the variety of residential treatment available in this area. If desired, a student can arrange for a special reading tutorial in related topics (e.g., schizophrenia). Weight: 4 or 8 Max: 4. *Oxley*

**PSC-251C. Community Psychiatry.** The student develops a course based on selections from a variety of community and special population settings. This includes the Durham Mental Health Center and its component units (children's services, alcohol and drug abuse and dependency treatment programs, programs for the care and training of the mentally retarded and adult psychiatry services), the Federal Corrections Center at Butner, and the psychiatric service at the Lincoln Community Health Center. Students interested in this elective must contact Dr. Dan Tweed at least four weeks prior to the term selected for this course in order to develop a program tailored to the student's interests. Weight: 4 or 8 Max: 8. *Tweed and Carter*

**PSC-260C. Neuropsychiatry.** Neuropsychiatry is the study of how alterations in brain structure and function produce disturbances in human behavior. In this course, the student becomes familiar with the major neuropsychiatric syndromes: dementia, delirium, and selective organic mental syndromes such as organic personality syndrome (e.g., frontal lobe syndrome) and organic affective syndrome (e.g., post-stroke depres-

sion). The student develops an understanding of diagnosis and treatment based upon a multidisciplinary clinical approach including specialized clinical neuropsychiatric exams. The patient population is drawn from the Duke Medical Center and Durham VA Hospital psychiatry, neurology, and neurosurgery services. Depending on the site, the student may also have an opportunity to become familiar with specialized neuropsychiatric approaches including psychometric testing and neural imaging techniques such as EEG and computerized EEG, CT scan, MRI, cerebral blood flow, and PET scan. Depending on site, some customization of the elective can be arranged in advance. Weight: 2-4 Max: 2. *Volow*

**PSC-280C. Modern Psychotherapy I: Intensive Clinical Introduction.** In this full-time (or near full-time) introduction, the student participates actively in assessment of outpatients for psychotherapy, short-term psychotherapy of inpatients, ongoing psychotherapy groups, and family therapy sessions. In addition he/she attends seminars on the various psychotherapeutic approaches: psychoanalytically oriented, cognitive, behavioral, interpersonal, systemic, etc. Readings are assigned and discussed. The student may pursue an area of special interest in greater depth with a selected preceptor. Weight: 4 Min: 1. *H. Kudler, E. Thompson, Gianturco, and Werman*

**PSC-343C. Clinical Aspects of Alcohol and Drug Abuse.** This course offers a part-time or full-time experience at the Duke Alcoholism and Addiction Program or the VA Hospital in the diagnosis and treatment for patients who abuse alcohol and/or drugs. The interrelations of substance abuse with personality disorder and major psychiatric disorder is emphasized. Students may also choose to rotate on an inpatient/outpatient substance abuse program at Duke Alcohol Program or the VA Hospital. Weight: 4-8 Min: 1 Max: 8. *Mathew and Stein*

**PSC-353C. Correctional/Forensic Psychiatry—Adult and Adolescent.** Part-time or full-time experience in a correctional setting is offered. Diagnosis and treatment of adult and adolescent offenders with a variety of medical illnesses and behavioral disturbances are recognized. Elements of forensic psychiatry are stressed where appropriate. Supervision is provided by Duke faculty and the Central Prison hospital and mental health staff. Opportunities for participation in a wide range of original and continuing research are available. Weight: 2-9 Max: 3. *Carter*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

- PSC 210B. Philosophy of Science and Behavioral Sciences
- PSC 220B. Sleep Disorders
- PSC 227C. Behavioral Aspects of Pediatrics
- PSC 245C. Psychosomatic Medicine
- PSC 275C. Assessment of Sleep Disorders and Treatment
- PSC 281C. Modern Psychotherapy II: Extended Psychotherapy Experience
- PSC 305B. Social and Cultural Aspects of Illness
- PSC 335C. Research Preceptorship in Clinical Psychiatry

## Radiation Oncology

Professor: Leonard Prosnitz, M.D. (State Univ. of New York, 1961), *Chairman*.

Professors: Mark W. Dewhirst, D.V.M., Ph.D. (Colorado, 1979); Edward C. Halperin, M.D. (Yale, 1969); Randy Jirtle, Ph.D. (Wisconsin, 1975); Gustavo S. Montana, M.D. (Bogota, Columbia, 1960).

Associate Professors: Mitchell S. Anscher, M.D. (Virginia, 1981); Thaddeus Samulski, Ph.D. (New York at Buffalo, 1975).

Assistant Professors: Jeffrey C. Acker, M.D. (Duke, 1989); David Brizel, M.D. (Northwestern, 1983); Scott Clegg, Ph.D. (Arizona, 1988); Stephen C. King, M.D. (North Carolina at Chapel Hill, 1988); Lawrence B. Marks, M.D. (Rochester, 1985); Jeffery D. Morton, M.D. (Yale, 1985); Deborah McLeod Prescott, D.V.M., Ph.D. (North Carolina State, 1989); Kenneth B. Weeks, Ph.D. (Texas at Austin, 1978).



Associates: Gunilla C. Bentel (Orebro Lans Sjukskoterskeskola, 1961); Anita Joy Hilliard, M.D. (Louisiana, 1989); Sally S. Ingram, M.D. (North Carolina at Chapel Hill, 1988); Catherine G. Lee, M.D. (South Florida, 1988).

## Electives

**RON-215C. Clinical Radiation Oncology.** Radiation oncology plays a crucial role in the management of patients with cancer. The student begins this course with lectures, individual tutorials, and audio-visual education programs to review the crucial elements of radiation biology, medical radiation physics, and dosimetry. This is followed by clinical instruction based in the ambulatory clinics of the Radiation Oncology Department as well as participation in brachytherapy procedures, care of inpatients, and new patient consultations. This course provides an introduction to the role of radiation therapy in the treatment of malignant disease. Weight: 4 or 8 Max: 2. *Halperin and staff*

**RON-228B. The Basic Science of Oncology.** In this course we discuss the molecular and cellular biology of cancer including oncogenes, tumor suppressor genes, growth factors, chromosomal abnormalities, cellular invasion and metastases, and the control of cell cycling. Tumor biology is considered including concepts of tumor doubling time, cell loss, tumor hypoxia, and fiber and foreign body, viral, and tobacco induced carcinogenesis/mutagenesis. The course concludes with a consideration of the basic science underlying cancer prevention, diagnosis, and therapy including the pharmacology of cancer chemotherapy, biologic and immunotherapy principles, radiobiology and hyperthermic oncology, and the scientific basis of surgical oncology practice. Weight: 3 Min: 3 Max: 25. *Halperin, Horowitz, and guest lecturers*

**RON-230B. Selected Topics in the Basic Science of Oncology.** During the spring semester of the third year, students in the Cancer Biology Study Program are required to enroll in this seminar format course. Each week, students read a group of selected papers pertinent to the class. Then, at the ensuing class sessions, one of the researchers of the Cancer Center discusses the readings with the students and explores their application in his/her own laboratory. At the end of the semester, students are asked to review their own research in a format similar to a graduate seminar. Course grading is based on class participation and on a research paper which reviews the literature pertinent to the student's selected research topic. Weight: 1. *Halperin, Bell, Horowitz, and Staff*

## ADDITIONAL COURSES WITH WRITTEN CONSENT OF INSTRUCTORS

RON-227B. General Radiobiology

### Basic Science Elective

**RON-228B. The Basic Science of Oncology.** In this course we will discuss the molecular and cellular biology of cancer including oncogenes, tumor suppressor genes, growth factors, chromosomal abnormalities, cellular invasion and metastases, and the control of cell cycling. Tumor biology will be considered including concepts of tumor doubling time, cell loss, tumor hypoxia, and fiber and foreign body, viral, and tobacco induced carcinogenesis/mutagenesis. The course will conclude with a consideration of the basic science underlying cancer prevention, diagnosis, and therapy including the pharmacology of cancer chemotherapy, biologic and immunotherapy principles, radiobiology and hyperthermic oncology, and the scientific basis of surgical oncology practice. Weight: 3: Min: 3: Max: 25. *Halperin, Horowitz, and guest lecturers*

### Clinical Science Elective

**RON-215C. Clinical Radiation Oncology.** Radiation oncology plays a crucial role in the management of patients with cancer. The student will begin this course with lectures, individual tutorials, and audio-visual education programs to review the crucial elements of radiation biology, medical radiation physics, and dosimetry. This will be

followed by clinical instruction based in the ambulatory clinics of the Radiation Oncology Department as well as participation in brachytherapy procedures, care of inpatients, and new patient consultations. This course will provide an introduction to the role of radiation therapy in the treatment of malignant disease. Weight: 4 or 8; Max: 2. *Halperin and staff*

## COURSE CURRENTLY UNSCHEDULED

### RON-227B: General Radiobiology

## Radiology

Professor: Carl E. Ravin, M.D. (Cornell, 1968), *Chairman*.

Professors: George S. Bisset III, M.D. (South Florida, 1975); James D. Bowie, M.D. (Oklahoma, 1967); Barbara Carroll, M.D. (Stanford, 1972); James T. T. Chen, M.D. (Natl. Defense Med. Ctr., Taiwan, 1950); R. Edward Coleman, M.D. (Washington Univ., 1968); Philip C. Goodman, M.D. (California at Los Angeles, 1970); Herman Grossman, M.D. (Columbia, 1953); E. Ralph Heinz, M.D. (Pennsylvania, 1955); Ronald Jaszczak, Ph.D. (Florida, 1968); G. Allan Johnson, Ph.D. (Duke, 1974); Salutaris Martinez, M.D. (Havana Univ., 1961); Rendon C. Nelson, M.D. (Loma Linda Univ., 1980); James B. Duke Professor Charles E. Putman, M.D. (Texas at Galveston, 1967); Tony P. Smith, M.D. (East Carolina, 1981); H. Dirk Sostman, M.D. (Yale, 1976); Leonard D. Spicer, Ph.D. (Yale, 1968); Michael R. Zalutsky, Ph.D. (Washington Univ., 1974).

Associate Professors: William H. Briner, B.S. (Temple, 1954); D. Lawrence Burk, Jr., M.D. (Pittsburgh, 1981); William Currie, Ph.D. (North Carolina at Chapel Hill, 1964); Carey Floyd, Jr., Ph.D. (Duke, 1981); William Foster, Jr. M.D. (Duke, 1973); Barbara Hertzberg, M.D. (Duke, 1980); Glenn E. Newman, M.D. (Duke, 1973); Charles Spritzer, M.D. (Pittsburgh, 1981); Robert D. Tien, M.D. (National Taiwan Univ., 1981); Robert H. Wilkinson, Jr., M.D. (Washington Univ. 1958).

Associate Clinical Professors: Roger H. Shannon, M.D. (George Washington, 1956); Robert Vandemark, M.D. (Upstate Med. Center, 1980).

Associate Research Professors: Laurence Hedlund, Ph.D. (Pittsburgh, 1968); Bruce Wieland, Ph.D. (Ohio State, 1973).

Assistant Professors: Hal Cecil Charles, Ph.D. (New Orleans, 1981); Andrew J. Collins, M.D. (New Jersey, 1983); James Dobbins III, Ph.D. (Wisconsin, 1985); David Enterline, M.D. (North Carolina at Chapel Hill, 1982); Gary J. Felsberg, M.D. (Boston, 1987); M. Gena Frederick, M.D. (Louisville, 1989); Donald P. Frush, M.D. (Duke, 1985); Katrina Glazebrook, M.B., Ch.B. (Auckland, 1985); Michael W. Hanson, M.D. (West Virginia, 1974); David M. Hough, M.B., Ch.B. (Christchurch, 1984); Mary T. Keogan, M.D. (Trinity College, 1985); Mark A. Kliewer, M.D. (Duke, 1985); Phyllis J. Kornuth, M.D., Ph.D. (Boston, 1976); Richard A. Leder, M.D. (Boston, 1984); Linda Gray Leithe, M.D. (Ohio State, 1982); Vincent Low, M.B.B.S. (Western Australia, 1983); James R. MacFall, Ph.D. (Maryland, 1976); H. Page McAdams, M.D. (Duke, 1986); Vincent McDermott, M.B., B.Ch., B.A.O. (Univ. College-Galway, 1982); Cindy R. Miller, M.D. (George Washington, 1985); Sara M. O'Hara, M.D. (Georgetown, 1988); Alan Osumi, M.D., Ph.D. (California at San Diego, 1986); Edward F. Patz, Jr., M.D. (Maryland, 1985); Cynthia Payne, M.D. (Med. Coll. of Ohio, 1980); Erik K. Paulson, M.D. (Duke, 1985); James M. Provenzale, M.D. (Albany, 1983); Mary Scott Soo, M.D. (Bowman Gray, 1987); Daniel J. Stackhouse, M.D. (North Carolina at Chapel Hill, 1988); Paul Suhocki, M.D. (Georgetown, 1985).

Assistant Clinical Professors: David Curtis, M.D. (Colorado, 1971); Michael L. Kerner, M.D. (Georgetown, 1975); Donald Wenzel, M.D. (Georgetown, 1968); Margaret Eileen Williford, M.D. (Duke, 1976).

Visiting Assistant Professor: Shaun G. McGee, M.B.B.S. (St. Thomas, 1985).

Assistant Research Professors: Robert Black, Ph.D. (Illinois, 1984); James Bowsher, Ph.D. (North Carolina at Chapel Hill, 1989); Timothy DeGrado, Ph.D. (Wisconsin, 1988); Pradeep Garg, Ph.D. (Lucknow Univ., 1982); David Gilland, Ph.D. (North Carolina at Chapel Hill, 1989); Jianying Li, Ph.D. (Duke, 1990); Bradley Smith, Ph.D. (Duke, 1988); Timothy Turkington, Ph.D. (Duke, 1989); Ganesan Vaidyanathan, Ph.D. (Kentucky, 1987).

Associates: Gian Abbott, M.B., Ch.B. (Liverpool, 1984); Sheri Albers, D.O. (North Texas State Univ., 1986); Yasmin Alexander, M.D. (Georgetown, 1987); Neil Davey, M.B., Ch.B. (Capetown, 1985); Carole Dentino, M.D. (Mt. Sinai, 1990); Charlotte Elenberger, M.D. (Med. Univ. of South Carolina, 1989); Jeremy Erasmus, M.B., Ch.B. (Witwatersrand, 1982); Joshua Farber, M.D. (Pennsylvania, 1988); Emily K. Folz, M.D. (Washington Univ., 1988); Vicken Garabedian, M.D. (Columbia, 1989); Bruce Hall, M.D. (Rochester, 1981); Bruce Hedgepeth, M.D. (Arizona, 1990); Cary Hoffman, M.D. (Boston Univ., 1989); Edwin R. Hudson, M.D. (East Tennessee, 1987); Jeremy Lawrance, M.B., Ch.B. (Capetown, 1985); Carolyn Maynor, M.D. (Duke, 1989); Brian McElaney, M.D. (St. Louis Univ., 1985); Thuan Nguyen, M.D. (Georgetown, 1989); Jeffrey Seabourn, M.D. (Nevada, 1990); Karen G. Seaton, M.D. (North Carolina at Chapel Hill, 1988); Amy Singer, M.D. (Temple, 1989); George M. Spencer, M.D. (East Carolina, 1989); Ruth Walsh, M.D. (Oklahoma, 1987); Fernando Zalduondo, M.D. (Columbia, 1989).



## Electives

**RAD-210C. Pediatric Radiology.** A specialized program of instruction and participation in the wide variety of radiographic examinations in the pediatric age group. Special correlation of these examinations to the problems of specific diagnosis and patient care is made. Prerequisite: must contact Dr. Miller prior to registration. Weight: 4 or 8 Max: 2. *Miller and staff*

**RAD-211C. Clerkship in Neuroradiology.** A specialized program of detailed instruction in neuroradiology. The program includes participation in many interdepartmental conferences and the performance and interpretation of a variety of examinations: including cerebral angiography, computerized axial tomography, magnetic resonance images, and myelography. Prerequisites: must contact Dr. Tien prior to registration. Weight: 4 or 8 Max: 2. *Tien and staff*

**RAD-229C. Basic Radiology Clerkship.** This course is designed to provide an overview of the various imaging modalities of diagnostic radiology and their clinical utility. The elective consists of: (a) lectures and film interpretation sessions supplemented by student presentations; (b) assignment to a variety of diagnostic radiology services during which students observe the performance of diagnostic and interventional studies; and (c) use of an extensive teaching file of radiographs and audiovisual tapes. One week is spent on the thoracic radiology service. Additional rotations may include the musculoskeletal, neuroradiology, mammography, vascular/interventional, pediatric, CT/abdominal imaging, ultrasound, MRI, nuclear medicine, and VA Hospital services. Weight: 4 Min: 4 Max: 8. *Collins and staff*

**RAD-250B. Research in Radiology.** An individually arranged experience in which the student identifies with and participates in an established research program of a faculty member. Program should be arranged with DPA and proposed faculty member well in advance of starting date. Weight: 1-16 Max: 10. *G.A. Johnson*

## Surgery

Professor Robert W. Anderson, M.D. (Northwestern, 1964), *Chairman*.

### DIVISION OF GENERAL SURGERY

Professor: Ralph R. Bollinger, M.D. (Tulane, 1970), Ph.D. (Duke, 1977), *Chief*.

Professors: Onyekwere Akwari, M.D. (Southern California, 1970); William G. Anlyan, M.D. (Yale, 1949); James B. Duke Professor Dani P. Bolognesi, Ph.D. (Duke, 1964), Experimental Surgery; J. W. and D. W. Beard Professor Eli Gilboa, Ph.D. (Weizmann Institute of Science, Israel, 1977), Experimental Surgery; John P. Grant, M.D. (Chicago, 1969); Karen S. Guice, M.D. (New Mexico, 1977); J. Dirk Iglehart, M.D. (Harvard, 1975); George S. Leight, Jr., M.D. (Duke, 1972); Richard L. McCann, M.D. (Cornell, 1974); William C. Meyers, M.D. (Columbia, 1975); Keith T. Oldham, M.D. (Med. Coll. of Virginia, 1976); Theodore N. Pappas, M.D. (Ohio State, 1981); J. W. and D. W. Beard Professor Jeffrey L. Platt, M.D. (California at Los Angeles, 1977), Experimental Surgery; Hilliard F. Seigler, M.D. (North Carolina at Chapel Hill, 1960); Delford L. Stickel, M.D. (Duke, 1953); David S. Warner, M.D. (Wisconsin, 1980); John L. Weinerth, M.D. (Harvard, 1967).

Research Professors: Per-Otto F. Hagen, F.H.W.C. (Watt University, Edinburgh, Scotland, 1961), Experimental Surgery; Alphonse J. Langlois, Ph.D. (Duke, 1966), Experimental Surgery.

Clinical Professor: Hartwiz Bunzendahl, M.D. (University of Heidelberg, 1974).

Associate Professors: Darell D. Bigner, M.D. (Duke, 1965), Ph.D. (Duke, 1971), Experimental Surgery; Pierre A. Clavien, M.D. (Geneva Med. School, 1985) Ph.D. (Univ. of Toronto, 1992); Gregory S. Georgiade, M.D. (Duke, 1973); H. Kim Lyerly, M.D. (California at Los Angeles, 1983); Thomas J. Matthews, Ph.D. (Missouri, 1971), Experimental Surgery; Emil R. Petrusa, Jr., Ph.D. (University of Utah, 1979); R. Lawrence Reed II, M.D. (Virginia, 1976); Debra A. Schwinn, M.D. (Stanford, 1983); Robert N. Sladen, M.B., Ch.B. (Univ. of Cape Town Med. Coll., South Africa, 1970); Kent J. Weinhold, Ph.D. (Pennsylvania, 1979), Experimental Surgery.

Associate Research Professor: Jeffrey R. Marks, Ph.D. (California, 1985), Experimental Surgery; David C. Montefiori, Ph.D. (Clemson, 1982).



Associate Clinical Professors: Norbertus P. DeBruijn, M.D., M.Sc. (Univ. of Gronigen, 1976); Brian J. McGrath, M.D. (Albany, 1982).

Adjunct Associate Professor: Jeffrey J. Collins, Ph.D. (Harvard, 1972), Experimental Surgery.

Assistant Professors: David B. Baldwin, Jr., M.D. (East Carolina, 1987), Emergency Medicine; Steven J. Bredhoeft, M.D. (Kansas, 1974); Kathleen A. Devine, M.D. (Maryland, 1987), Emergency Medicine; W. Steve Eubanks, Jr., M.D. (Alabama, 1987); Robert C. Harland, M.D. (Duke, 1983); Samuel M. Mahaffey, M.D. (West Virginia, 1979); Barbara A. Murphy, M.D. (Med. Coll. of Pennsylvania, 1975), Emergency Medicine; Glenn E. Newman, M.D. (Duke, 1973); Mark W. Sebastian, M.D. (Rush Medical College, 1987); Bruce A. Sullenger, B.S. (University of Indiana), Experimental Surgery; Douglas S. Tyler, M.D. (Dartmouth, 1985); Steven N. Vaslef, M.D. (Virginia, 1984); Frances E. Ward, Ph.D. (Brown, 1965), Experimental Surgery; David K. Wellman, M.D. (Duke, 1971), Emergency Medicine.

Assistant Research Professors: Zeinab A. Abdel-Wahab, Ph.D. (Eastern Virginia, 1985), Experimental Surgery; Timothy L. Darrow, Ph.D. (State Univ. of New York, 1980); Michael L. Greenberg, Ph.D. (State Univ. of New York, 1984), Experimental Surgery; Emmanuel C. Opar, Ph.D. (Univ. of London, 1984); William R. Parker, Ph.D. (Univ. of Nebraska, 1992); Soheyla S. Saadi, Ph.D. (New York Univ., 1985).

Assistant Clinical Professors: David N. DuBois, M.D. (Georgetown, 1983); Paul C. Hendrix, B.S. (Coll. of Charleston, 1970), B.H.S. (Duke, 1975); C. Michael Schuch, B.A. (North Carolina at Chapel Hill, 1977).

Assistant Consulting Professors: Toney W. Baskin, M.D. (Louisiana State, 1968); George M. Bilbrey, Jr., M.D. (Alabama, 1962); Albert H. Bridgman, M.D. (Louisiana, 1956); Rollins S. Burhans, Jr., M.D. (Louisville, 1963); William H. H. Chapman III, M.D. (Dartmouth, 1987); Eduardo Cuison, M.D. (College of Medicine and Surgery, Santo Tomas, 1967); John T. Daniel, M.D. (Howard, 1964); William E. Eggebroten, M.D. (Jefferson, 1977); Peter A. Gentling, M.D. (Northwestern, 1964); Norman A. Hetzler, Jr., M.D. (Hahnemann, 1982); John D. Holcomb, M.D. (Arkansas, 1985); Charles A. Keller, Jr., M.D. (Louisiana State, 1959); Robert W. Kieffer, M.D. (Johns Hopkins, 1978); Julie E. Little, M.D. (Harvard, 1987); Walter J. Loehr, M.D. (Cornell, 1963); Kim R. Marley, M.D. (Wayne State, 1983); Keith M. Maxwell, M.D. (Oral Roberts, 1982); Amir A. Neshat, M.D. (Isfahan Univ., Iran, 1960); Michael A. H. Remar, M.D. (George Washington, 1985); Stephen K. Rerych, M.D. (Columbia, 1974); Henry E. Russell, M.D. (Northwestern, 1972); Guido F. Saldana, M.D. (Santo Domingo Univ., 1961); David J. Seel, M.D. (Tulane, 1948); Phillip P. Shadduck, M.D. (California, 1986); James P. Weaver, M.D. (Pennsylvania, 1969); James S. Wilson, Jr., M.D. (North Carolina at Chapel Hill, 1975).

Adjunct Assistant Professor: Stephen R. Petteway, Jr., Ph.D., (Alabama, 1980), Experimental Surgery.

Research Associates: Chin Ho Chen, Ph.D. (North Carolina at Chapel Hill, 1985); Penelope L. Davis, Ph.D., (Birmingham Medical School, 1992); Ahmed A. Farag, M.D. (Cairo University, Egypt, 1986); Guido Ferrari, M.D. (Univ. of Medicine of Genoa, 1985); Sanford Garner, Ph.D. (North Carolina, 1989); Gudrun Huper, M.A. (Stuttgart, Germany); Nathan S. Ihrcke, Ph.D. (Minnesota, 1991); Simon F. Lacey, Ph.D. (Imperial Coll. of London, 1990); Seong-Wook Lee, Ph.D. (Cornell, 1994); Lynn M. Milich, Ph.D. (University of North Carolina, 1994); Robin S. Monroe, Ph.D. (Duke, 1989); Smitha K. Nair, Ph.D. (Tennessee, 1993); Kave N. Nikbakht, Ph.D. (University of Tennessee, 1986); Coreen Q. H. Oei, Ph.D. (National Institute of Singapore, 1992); Angel Porgador, Ph.D. (Weizmann Inst. of Science in Rehovot, Israel, 1989); Laurence T. Rimskey-Clarke, Ph.D. (Univ. of Paris, 1984); James P. Vaughn, Ph.D. (Virginia, 1991); Carl T. Wild, Ph.D. (Virginia Polytechnic and State Univ., 1988); Jintao Zhou, Ph.D. (Shanghai Univ., China, 1985); Jiying Zhou, Ph.D., (Chinese Pharmaceutical University at Shenyang, China, 1984).

## **DIVISION OF THORACIC SURGERY**

Professor: Peter K. Smith, M.D. (Duke, 1977), *Chief*.

Professors: Mary and Deryl Hart Professor of Surgery Robert H. Jones, M.D. (Johns Hopkins, 1965); James E. Lowe, M.D. (California at Los Angeles, 1973); H. Newland Oldham, Jr., M.D. (Baylor, 1961); James B. Duke Professor David C. Sabiston, M.D. (Johns Hopkins, 1947); Ross M. Ungerleider, M.D. (Rush, 1976); Peter Van Trigt III, M.D. (Tulane, 1977); Walter G. Wolfe, M.D. (Temple, 1963); W. Glenn Young, Jr., M.D. (Duke, 1948).

Consulting Professor: Steward M. Scott, M.D. (Baylor, 1951).

Associate Professors: Donald D. Glower, Jr., M.D. (Johns Hopkins, 1980).

Assistant Professors: Robert Duane Davis, M.D. (California, 1984); James W. Gaynor, M.D. (Med. Coll. of South Carolina, 1982); Ares D. Pasipoularides, M.D. (Minnesota, 1971), Ph.D. (Minnesota, 1972); Lloyd R. Smith, Ph.D. (Alabama, 1985).

Assistant Research Professors: Salah M. Abdel-Aleem, Ph.D. (The City University of New York, 1988); James W. Davis, Ph.D. (Duke, 1993); Lawrence H. Muhlbaier, Ph.D. (North Carolina at Chapel Hill, 1981), Experimental Surgery.

Assistant Consulting Professors: Ralph S. Christy, Jr., M.D. (North Carolina at Chapel Hill, 1983); Calvin P. Claxton, M.D. (Virginia, 1961); F. Maxton Mauney, Jr., M.D. (Duke, 1959); Wayne H. Welscher, M.D. (Upstate Med. Sch., 1975).

Research Associates: Chin Ho Chen, Ph.D. (North Carolina at Chapel Hill, 1985); Martha M. Demes, Ph.D. (Duke, 1984); Leslee J. Shaw, Ph.D. (St. Louis University, 1994).

## DIVISION OF NEUROSURGERY

Professor: Robert H. Wilkins, M.D. (Pittsburgh, 1959), *Chief*.

Professor: Allan H. Friedman, M.D. (Illinois, 1974).

Associate Professors: Cecil O. Borel, M.D. (Hahnemann, 1977); Wesley A. Cook, Jr., M.D. (Oregon, 1963); Dennis A. Turner, M.D. (Indiana, 1975).

Associate Research Professor: Roger Madison, Ph.D. (Duke, 1981), Experimental Surgery.

Assistant Professors: Herbert E. Fuchs, M.D., Ph.D. (Duke, 1984); John P. Gorecki, M.D. (Queens Univ., Canada, 1983); Michael M. Haglund, M.D. (Univ. of Washington, 1987) Ph.D (Univ. of Washington, 1988); William J. Richardson, M.D. (Eastern Virginia, 1977); Bruno J. Urban, M.D. (Germany, 1960).

Assistant Research Professor: Simon J. Archibald, Ph.D. (North Staffordshire Polytechnic, Bioengineering Unit, 1984).

Assistant Clinical Professor: Ziaur Rahman, M.B. (Prince of Wales Med. Coll., India, 1968).

Assistant Consulting Professors: Peter R. Bronec, M.D. (Duke, 1981); Bruce L. Kihlstrom, M.D. (North Carolina at Chapel Hill, 1972); Robert E. Price, Jr., M.D. (North Carolina at Chapel Hill, 1964).

Research Associates: Janice O. Levitt, Ph.D. (Temple, 1963); Robert D. Pearlstein, M.S. (North Carolina at Chapel Hill, 1978); Gowri K. Pyapali, Ph.D. (Nehru Univ., India, 1989); Darion Rapoza, Ph.D. (Chicago, 1990); Maria Rapazo, Ph.D. (Duke, 1994); Ashok K. Shetty, Ph.D. (All India Inst. of Medical Science, India, 1990).

## DIVISION OF ORAL SURGERY

Assistant Professor: Thomas A. McGraw, D.D.S. (Pennsylvania, 1985).

Assistant Clinical Professor: Edward A. Dolan, D.D.S. (Maryland, 1971).

Assistant Consulting Professor: George A. Walsh, D.D.S. (Georgetown, 1972).

## DIVISION OF ORTHOPAEDIC SURGERY

Virginia Flowers Baker Professor: James R. Urbaniak, M.D. (Duke, 1962), *Chief*.

Professors: Frank H. Bassett III, M.D. (Louisville, 1957); Donald E. McCollum, M.D. (Bowman Gray, 1953); James H. McElhaney, Ph.D. (West Virginia, 1964), Experimental Surgery; James A. Nunley, M.D. (Tulane, 1973).

Associate Professors: John A. Feagin, M.D. (Duke, 1961); William E. Garrett, M.D., Ph.D. (Duke, 1976); Richard D. Goldner, M.D. (Duke, 1974); William T. Hardaker, Jr., M.D. (Duke, 1973); John M. Harrelson, M.D. (Duke, 1964).

Assistant Professors: Robert D. Fitch, M.D., (Duke, 1976); Reginald Hall, M.D. (Duke, 1983); Stephen N. Lang, M.D. (Illinois, 1965); L. Scott Levin, M.D. (Temple, 1982); Salutaris Martinez, M.D. (Havana Univ., 1961); Barry S. Myers, M.D., Ph.D. (Duke, 1991); William J. Richardson, M.D. (Eastern Virginia, 1977); Sean P. Scully, M.D., Ph.D. (Rochester, 1986); Kevin P. Speer, M.D. (Johns Hopkins, 1985); T. Parker Vail, M.D. (Loyola, 1985).

Assistant Research Professors: Long-en Chen, M.D. (Peking Med. Coll., China, 1967), Ph.D. (Shanghai, 1983); Farshid Guilak, Ph.D. (Columbia University, 1991).

Assistant Consulting Professors: Quinn H. Becker, M.D. (Louisiana State, 1956); Edward W. Bray III, M.D. (Med. Univ. of South Carolina, 1971); William J. Callison, M.D. (Vanderbilt, 1953); Edwin B. Cooper, Jr., M.D. (Duke, 1966); J. Lawrence Frank, M.D. (Duke, 1965); H. John Gerhard, M.D. (Harvard, 1981); Stephen A. Grubb, M.D. (Northwestern, 1974); C. Robert Lincoln, M.D. (Med. Coll. of Virginia, 1960); William J. Mallon, M.D. (Duke, 1984); Ronald J. Neimkin, M.D. (Cornell, 1975); William S. Ogden, M.D. (Med. Coll. of Georgia, 1965); Theodore M. Pitts, M.D. (Yale, 1977); Edwin T. Preston, Jr. M.D. (Duke, 1960); Glydon B. Shaver, Jr., M.D. (Tennessee, 1961).

Consulting Associates: Richard F. Bruch, M.D. (Illinois, 1972); Albert T. Jennette, M.D. (North Carolina at Chapel Hill, 1959); Ronald A. Pruitt, M.D. (Med. Coll. of Virginia, 1959); William A. Somers, M.D. (Duke, 1972).

Research Associates: Wen-ning Qi, M.D. (Peking Union Med. Coll., China, 1967); Anthony V. Seaber.

## DIVISION OF OTOLARYNGOLOGY

Professor: William J. Richtsmeier, M.D. (Case Western Reserve, 1975), Ph.D. (Med. Coll. of Wisconsin, 1975), *Chief*.

Professors: Joseph C. Farmer, Jr., M.D. (Duke, 1962); William R. Hudson, M.D. (Bowman Gray, 1951).

Associate Professors: Samuel R. Fisher, M.D., (Duke, 1975); Patrick D. Kenan, M.D. (Duke, 1959).

Associate Medical Research Professor: John H. Casseday, Ph.D. (Indiana, 1970).

Assistant Professors: Richard A. Clendaniel, Ph.D. (Alabama, 1992); Gregory F. Hulka, M.D. (Duke, 1988); Richard L. Scher, M.D. (Cincinnati, 1985); Debra L. Tucci, M.D. (Virginia, 1985).

Assistant Research Professors: David W. Smith, Ph.D. (Michigan, 1986); Christopher Van den Honert, Ph.D. (Case Western Reserve, 1979).

Assistant Consulting Professors: Beverly J. Adams, M.D. (Duke, 1977); Charles E. Clark III, M.D. (Michigan, 1968); Lynn A. Hughes, M.D. (Oklahoma, 1968); David J. Seel, M.D. (Tulane, 1948); Robert E. Taylor, M.D. (Alabama, 1976); C. Emery Williams, M.D. (Louisiana, 1963).



Adjunct Assistant Professors: Charles C. Finley, M.D. (North Carolina at Chapel Hill, 1983); Dewey T. Lawson, Ph.D. (Duke, 1972); Blake S. Wilson, B.S. (Duke, 1974).

Consulting Associates: Peter G. Chikes, M.D. (North Carolina at Chapel Hill, 1972); Edward V. Hudson, M.D. (Bowman Gray, 1962).

Research Associate: Shuwan Xue, Ph.D. (Boston University, 1992).

## **DIVISION OF PLASTIC AND MAXILLOFACIAL SURGERY**

Professor: Donald Serafin, M.D. (Duke, 1964), *Chief*.

Professors: Robert M. Mason, D.M.D. (Kentucky, 1977), M.S.O. (North Carolina at Chapel Hill, 1979), Orthodontics; Galen W. Quinn, D.D.S. (Creighton, 1952), Orthodontics.

Associate Professor: Gregory S. Georgiade, M.D. (Duke, 1973).

Associate Clinical Professor: Ronald Riefkohl, M.D. (Tulane, 1972).

Associate Consulting Professor: Verne C. Lanier, Jr., M.D. (Vanderbilt, 1966).

Assistant Professors: James A. Hoke, D.D.S. (Ohio State, 1972), M.S. (Michigan, 1976), Dentistry; L. Scott Levin, M.D. (Temple, 1982); Edmond F. Ritter, M.D. (Washington Univ., 1984); Gregory L. Ruff, M.D. (Michigan, 1978); Rainer E. Sachse, D.D.S. (Friedrich-Alexander University, 1981) M.D. (Friedrich-Alexander University, 1983).

Assistant Research Professor: Bruce M. Klitzman, B.S.E. (Duke, 1974), Ph.D. (Virginia, 1979).

Assistant Clinical Professor: Martha A. Keels, D.D.S. (North Carolina at Chapel Hill, 1984), M.S., Ph.D. (North Carolina at Chapel Hill, 1990), Dentistry.

Consulting Associate: James T. White, D.D.S. (Loyola, 1966), M.S. (North Carolina at Chapel Hill, 1976), Dentistry.

## **DIVISION OF UROLOGIC SURGERY**

Professor: David F. Paulson, M.D. (Duke, 1964), *Chief*.

Professors: E. Everett Anderson, M.D. (Duke, 1958); Lowell R. King, M.D. (Johns Hopkins, 1956); Glenn M. Preminger, M.D. (New York Med. Coll., 1977); Philip J. Walther, M.D., Ph.D. (Duke, 1975); George D. Webster, M.B., Ch.B. (Univ. Coll. of Rhodesia, 1968); John L. Weinerth, M.D. (Harvard, 1967).

Associate Professor: Cary N. Robertson, M.D. (Tulane, 1977).

Associate Research Professor: Pei Zhong, Ph.D. (Texas Southwestern Med. Center, 1992).

Associate Consulting Professor: John H. Grimes, M.D. (Northwestern, 1965).

Assistant Professors: Craig F. Donnatucci, M.D. (Temple, 1979)

Assistant Research Professors: John W. Day, Ph.D. (Iowa, 1972)

Assistant Clinical Professor: Andrew F. Meyer, M.D. (New York, 1969).

Assistant Consulting Professors: Niall J. Buckley, M.B., B.Ch. (University College Dublin, 1979); Hector H. Henry II, M.D. (Tulane, 1965); Raymond E. Joyner, M.D. (Bowman Gray, 1968); Ignacio Sarmina, M.D. (Med. Coll. of Ohio, 1982); Sigmund I. Tannenbaum, M.D. (Duke, 1975); Wade S. Weems, M.D. (Duke, 1962); Arthur W. Whitehurst, M.D. (Virginia, 1968).

Clinical Associate: Steven H. Herman, Ph.D. (Duke, 1977).

Medical Center Instructors: Robert W. Andrews, M.D. (Bowman Gray, 1980); Oscar W. Brazil, Jr., M.D. (Louisiana, 1961).

## **PROGRAM IN HEARING AND SPEECH DISORDERS**

Associate Professors: Jennifer Horner, Ph.D. (Florida, 1977); Bruce A. Weber, Ph.D. (Illinois, 1966).

Associates: Burton B. King, M.A. (Northwestern, 1955); Robert G. Paul, Ph.D. (Oklahoma, 1969).

Emeriti: D. Bernard Amos, M.D.; John C. Angelillo, D.D.S., Lennox D. Baker, M.D.; Frank W. Clippinger, M.D.; Eugene D. Day, Ph.D.; Nicholas G. Georgiade, D.D.S., M.D.; J. Leonard Goldner, M.D.; Blaine S. Nashold, M.D.; Guy L. Odom, M.D.; William P. J. Peete, M.D.; Raymond W. Postlethwait, M.D.; Will C. Sealy, M.D.; James H. Semans, M.D.; William W. Shingleton, M.D.

## **Required Course**

**SUR-205C. Surgery.** The required course in surgery, is given in the second year and consists of an eight week clinical clerkship. The primary goal is the presentation of those concepts and principles which characterize the discipline of surgery. The fundamental features which form the foundation of surgical practice are presented at seminars three times weekly. The subjects discussed include antisepsis, surgical bacteriology, wound healing, inflammation, fluid and electrolyte balance, shock, the metabolic response to trauma, biology of neoplastic disease, gastrointestinal physiology and its derangements, and blood coagulation, thrombosis, and embolism.

The students are divided into two groups, one at Duke and the other at the Veterans Administration Medical Center, and each works with two members of the surgical faculty. Students are assigned patients on the surgical wards for diagnosis and management, and clinical rounds are made three times weekly with the faculty. A full-time



teaching resident is assigned for the course in order to provide the students with continuous and readily available instruction at all times. A one hour session is devoted daily to demonstrations by the surgical specialties including neurosurgery, orthopaedics, otolaryngology, plastic surgery, and urology. The students attend a weekly session in experimental surgery, during which each student serves in rotation as the anesthesiologist, first assistant, and operating surgeon in performance of surgical procedures on experimental animals. Weight 8. *Sabiston*

### **Electives**

**SUR-219C. Advanced General and Thoracic Surgery (VA Hospital).** The student will function as a sub-intern in surgery. Special attention will be given to those subjects in surgery common to all medical practices. Patients will be assigned to the students who will assume primary responsibility for their care under the supervision of the faculty and residents. The major emphasis will be on physiologic and pathologic changes, diagnosis, indications for operation, and observation of surgical procedures. Prerequisite: permission of Dr. Wolfe. Weight: 8. Max: 3. *Wolfe*

**SUR-227C. Advanced Urologic Clerkship.** The diagnosis, management, and surgical treatment of patients with urologic disorders will be stressed. Students will be afforded intimate association with the entire staff in the clinics, wards, and operating rooms and will participate in surgery. Cystoscopic and urographic diagnostic methods along with other techniques will be taught. Weight: 4 or 8. Max: 6. *Paulson, Anderson, King, Weinerth, Webster, Carson, Walther, and Robertson*

**SUR-228C. Clerkship in Pediatric Urology.** Designed to give an overview of urologic problems in the pediatric population. Will include patient contact and seminar material as well as ward and operating room experience in the diagnosis, treatment, and long-term follow-up of children with urologic disease. Weight: 4. Min: 1 Max: 2. *King*

**SUR-230C. Seminar in Urologic Diseases and Techniques.** Lecture/seminar course by members of the staff in Urology and Radiology providing an introduction to the spectrum of urologic diseases amplified by demonstration of urologic and radiologic diagnostic methodology. Clinical problems to be stressed include pediatric urology, obstructive uropathies, urinary calculi, male infertility, impotence, trauma, urodynamics, reconstructive urology, and urologic malignancies. Informal seminars given weekly. If permitted by the instructor, this clinical science course can be audited. Weight: 2. Min: 3 Max: 8. *Paulson, Anderson, King, Weinerth, Webster, Carson, Walther, Robertson, and Dunnick*

**SUR-233C. Basic Neurosurgery Course.** Disease conditions commonly encountered by neurosurgeons are presented. Clinical presentation of a disorder such as brain tumor or head injury is made by a member of the staff. Clinical features and plan of diagnostic investigation are stressed. The clinical disorder is used as a focal point from which to carry the presentation into the basic sciences that are related to the clinical problem. Prerequisites: student must have the approval of Dr. Cook to register for this course. Weight: 1 Min: 3 Max: 20. *Cook, Friedman, Fuchs, Kramer, Turner, and Wilkins*

**SUR-235C. Clinical Neurosurgery.** The course is designed for those students with a career interest in one of the neurological sciences. Duties include the work up and care of inpatients, work up of clinic patients, assistance in the operating room, daily rounds, and night call. Weekly conferences are held in neurosurgery, neurology, neuropathology, and neuroradiology. There are also special lectures. Prerequisites: student must have the approval of Dr. Wilkins to register for this course. Weight: 4 or 8. Max: 4. *Wilkins, Cook, Friedman, Fuchs, Kramer, Nashold, and Turner*

**SUR-236C. Intermediate Clinical Neurosurgery.** This elective, intended as an intermediate experience between SUR 233C and SUR 235C, focuses on the clinical presentation of common neurosurgical disorders, radiographic evaluation, and therapeutic options including the indications and contraindications for surgical intervention.

The student will work up one to three patients and assist at their operations the following day either once or twice per week and will attend the Saturday, neurosurgical conference. Prerequisites: permission of instructor. Weight: 1 or 2. Max: 1. *Wilkins*

**SUR-237C. Investigative Neurosurgery.** The student is assigned a project relating to neurologic sciences and, within reason, is provided with technical help, recording equipment, and experimental animals necessary for its completion. Each student plans and executes his own individual project with the help of the neurosurgery staff. Attendance at weekly conferences is also required. Prerequisites: SUR 235C suggested. The student must have the approval of Dr. Wilkins and Dr. Turner to register for this course. Weight: 8. Max: 2. *Turner, Fuchs, Madison, and Nashold*

**SUR-239C. Clinical Otolaryngology.** This course will provide the student with a comprehensive survey of clinical otolaryngology. Duties will include participation in both outpatient clinic activities and inpatient care in addition to assisting in the operating room. The student will participate in ward rounds and in various conferences held by the division. Weight: 4 or 8. Max: 2. *Scher, Richtsmeier, Kenan, Cole, Farmer, Fisher, and McElveen*

**SUR-240C. Otolaryngology Seminar.** This conference and demonstration course will provide an introduction to a variety of clinical problems in otolaryngology. Lectures will be supplemented with case presentations illustrating problems encountered in this field. If permitted by the instructor, this clinical science course can be audited. Weight: 1. Min: 4 Max: 6. *Richtsmeier*

**SUR-244C. Introduction Plastic, Reconstructive and Maxillofacial Surgery.** This course is designed for students who may have a future interest in plastic surgery. Duties include the preoperative evaluation of patients, assisting in the operating room, making daily ward rounds, and participation in conferences. Weight: 4. *Serafin, G. Georgiade, Ruff, Levin, and Ritter*

**SUR-246C. Clerkship in Plastic and Reconstructive Surgery.** The student participates in evaluation and management of plastic surgery patients including preoperative assessment, surgical assistance, and postoperative follow-up in a private office and at Durham Regional Hospital. Daily seminars cover core topics such as skin and surgical techniques, wound healing, and scars. Prerequisite: permission of instructor. Weight: 4. Max: 1. *Serafin*

**SUR-247C. Plastic Surgery Research.** Students will be engaged in scholarly activities which are active, in-depth learning experiences related to microvascular, plastic, and/or reconstructive surgery. The students will be expected to design, execute, and analyze data and to formulate hypotheses and draw conclusions from their projects. Weight: 1-8. Max: 4. *Klitzman and Serafin*

**SUR-255C. Directed Study in Speech/Language Pathology and Audiology.** Individual directed study in selected topics concerning normal and abnormal hearing, language and speech functions. In consultation with a faculty member, each student will select one or more topics within the following areas: (a) the auditory system and hearing loss; (b) development and disorder of language and speech of children; (c) language and speech disorders of neurologically impaired adults (aphasia, dementia, neglect, dysarthria, dysphagia syndromes); (d) voice disorders and laryngectomy; (e) speech disorders secondary to cleft palate and other craniofacial anomalies; (f) stuttering. Emphasis on fundamentals of normal and abnormal function and principles of evaluation and management of disorders in each area. Prerequisite: permission of instructor. Weight: 1. *Weber, Horner, Riski, and King*

**SUR-259C. General Principles of Orthopaedics.** A full experience on the Orthopaedic Service with duties and responsibilities similar to a junior intern. Inpatient care,



outpatient examination, and operating room experience are included. Individual or group discussions each day with attending staff/residents. The purpose of the course is to present broad concepts of orthopaedics to students planning general practice, pediatrics, allied surgical specialties or orthopaedics. Weight: 4 or 8 Max: 6. *Urbaniak, Clippinger, McCollum, Bassett, Harrelson, Hardaker, Nunley, R. Goldner, Garrett, Fitch, Lang, Richardson, Feagin, and Hall*

**SUR-267C. Introductory Clinic Course in Cerebral Palsy and Children's Orthopaedics.** This introductory clinic course is arranged for those interested in neurological disease, pediatric orthopaedic problems, and related fields. This will give the student a working experience in the examination and evaluation of patients under clinical conditions which demonstrates both the individual and multidisciplinary group approach to the whole patient with complex neurologic and orthopaedic conditions as they affect both growth and development. Out-patients and in-patients are utilized for subject material. Staff personnel are readily available for individual discussion and seminars. Weight: 2 or 4. Max: 2. *Coonrad, Fitch, and cerebral palsy staff*

**SUR-275C. Pediatric Cardiac Surgery.** The student will become an active member of the surgical team caring for infants and children with congenital heart defects. Responsibilities will include ward work and participation during surgery. This student will be involved in perioperative decision making and weekly formal didactic sessions will be provided. Weight: 2. Max: 2. *Ungerleider*

**SUR-276C. Advanced Clerkship in Pediatric Surgery.** This course is designed to familiarize the student with the whole range of surgical problems in children, but with emphasis on the pathophysiology of surgical and related problems in the newborn infant and the total care of the child with a malignancy. The student is encouraged to participate fully in the patient care aspects of the service and is considered an integral part of the patient care team. Although the course may be taken for the full eight weeks, it is felt that a four week experience is probably optimal for most students. It may be combined with other advanced surgical clerkships such as Surgery 299C or with four weeks of neonatology, Pediatrics 225C, or other courses depending on the interests of the student. Prerequisites: brief pre-enrollment interview with Dr. Keith Oldham. Weight: 4 or 8. Max: 2. *K. Oldham and Mahaffey*

**SUR-277C. Orthopaedic Research.** Individual projects are assigned for completion during a limited period of time. A student works with an investigator in the orthopaedic laboratory either at Duke Medical Center or the Durham Veterans Administration Hospital. Clinical investigation studies are also available at both institutions. Weight: 8. Max: 4. *Urbaniak, Bassett, Harrelson, R. Goldner, Garrett, orthopaedic senior staff, and house staff*

**SUR-280C. General Surgical Oncology.** The course is designed for the student interested in surgical oncology. The students will be involved in patient care with a specific surgeon, but in addition, will be expected to attend multidisciplinary conferences related to gastrointestinal and breast carcinoma. These multidisciplinary conferences involve medical and radiation oncology as well as surgical oncology. The student is also expected to evaluate surgical patients in an outpatient setting as well as participating in inpatient and operative patient care. This course is designed for students who have an interest in the basic sciences in relation to surgical oncology. Attendance at research conferences involved in the molecular and cellular biology of human cancers is also expected. Permission of instructor is required. Weight: 4. Min:1 Max: 2. *Lyerly*

**SUR-281C. Introduction to Fractures and Musculoskeletal Trauma.** Students will participate in the emergency management of patients through the Duke Emergency Room or through Durham Regional Hospital. Principles of fractures in trauma will be given throughout the week at specified times. Attendance at Fracture Conference will



be required on Wednesdays and Saturdays at 7:00 a.m. in addition to two nights on call in the emergency room of either Duke University Medical Center or Durham Regional Hospital. Seeing patients in the Out-Patient Clinic one day per week is required. Entire orthopaedic staff at Duke or Durham Regional Hospital supervised by Dr. Urbaniak at Duke, Dr. Lincoln at Durham Regional Hospital. Weight: 3. Max: 4. *Urbaniak and Lincoln*

**SUR-283C. Advanced Surgery—Emphasis Cardiovascular/Thoracic.** Advanced concepts in surgery will be presented in seminars and in ward, clinic, and operating room experiences. Fifty to seventy-five percent of the time will be devoted to cardiovascular/thoracic surgery and related basic topics and the remainder to surgery generally. Weight: 8. Min: 2 Max: 5. *Sabiston, Jones, Lowe, Smith, Ungerleider, Van Trigt, Wolfe, and Young*

**SUR-299C. Advanced Surgical Clerkship.** This course is structured to provide the student with a comprehensive approach to surgical disorders. Each student will work in the clinics, on the wards, and in the operating rooms side by side with one senior surgeon to be selected from the approved list below. Weight: 5 or 10. *Sabiston, Akwari, Bollinger, Douglas, G. Georgiade, Glower, Grant, Iglehart, Jones, Leight, Lowe, Lyerly, Meyers, McCann, Oldham, Pappas, Peete, Seigler, Smith, Stickel, Ungerleider, Van Trigt, Vernon, Wolfe, and Young*

**SUR-300C. Surgical Critical Care.** The course is designed to broaden the student's knowledge and experience in dealing with critically ill patients. Under supervision, students will function as sub-interns in the Surgical Intensive Care Unit. Scheduled activities include daily lectures by the SICU attending staff and twice-daily SICU rounds. Through these experiences, students become familiar with critical care topics including cardiovascular resuscitation and support, ventilator management, hemodynamic assessment, prevention and management of nosocomial infections, and monitoring and support. Each student is responsible for participating actively in the care of at least one critically ill patient at a time. Students will be formally evaluated by the Critical Care Housestaff and the attending physician. Weight: 5. Min: 2 Max: 4. *Reed, Moylan, and Sladen*

**SUR-301C. Emergency Department Surgical Care.** Students desiring additional experience working with care of emergency surgical patients will be assigned to the Emergency Department one night per week for each credit desired. They will participate in the diagnosis and care of acute and traumatic surgical emergencies. Weight: 1-3. Max: 8. *Wellman*

**SUR-302C. Family Practice/Traumatology.** The student spends a portion of each day in the ski clinic triaging acute ski injuries and seeing family practice type problems coincident with a small community clinic. In addition, there is office practice in the physician's offices contiguous with St. John's Hospital, Jackson Hole, Wyoming under the directorship of Dr. Richard Sugden and Dr. Kenneth Lambert. Both are board certified in their specialties and hold university appointments. The unique opportunities of this travel away experience are to see the excellence that can be accomplished in a setting of this nature, and to benefit from the mentorship of these outstanding individuals, and as well as to add to their own experience in both family practice and orthopaedic traumatology. Weight: 4. Min: 1 Max: 1. *Sugden and Lambert*

**SUR-303C. Trauma Service.** This course is designed to provide students interested in trauma care with further experience both in the Emergency Department and on the Inpatient Trauma Service. The course will emphasize both triage and resuscitation for major and minor emergency problems in the Emergency Department and also pre- and postoperative care on the Inpatient Trauma Service. The student will have a full-time experience by assuming duties and responsibilities similar to a junior intern. Emphasis will be placed on developing skills in the care of patients with multisystem injuries in

the Emergency Department, Inpatient Service, and Operating Room. Students will work in conjunction with the attending staff and the residents on the Trauma Service. Weight: 4. Max: 2. *Moylan, G. Georgiade, Pappas, and Reed*

**SUR-304C. Nutrition in the Hospitalized Patient.** This course is designed to acquaint students with the techniques of nutritional assessment including somatic protein, visceral protein mass, body fat mass, immune competence, and metabolic balance studies. Students will learn to determine basal energy expenditure and nitrogen requirements. The metabolic effects of acute and chronic starvation as well as stress and infection and the role played by these events in the hospital course of patients will be studied. Emphasis will be placed on techniques of nutritional support including routine and specialized hospital diets, routine and modular tube feeding diets, peripheral intravenous protein sparing and total parenteral nutrition. At the completion of the course, students will have a thorough grasp of clinical nutrition and be able to apply specialized oral diets, tube feeding diets, and intravenous nutrition. If permitted by the instructor, this clinical science course can be audited. Weight: 1. Min: 3 Max: 8. *Grant*

### **COURSES CURRENTLY UNSCHEDULED**

**SUR-221C. Surgical Specialties and Ophthalmology (VA Hospital)**

**SUR-234C. Pediatric Neurosurgery**

**SUR-242C. Biological Basis of Hearing**

**SUR-245C. Advanced Plastic, Reconstructive and Maxillofacial Surgery**

**SUR-261C. Office And Ambulatory Orthopaedics**

**SUR-282C. Advanced Surgery—Emphasis Cancer**

**SUR-284C. Advanced Surgery—Emphasis Transplantation**

### **Special Interdisciplinary Course**

**IND-300C. Interdisciplinary Seminar in Medical-Legal-Ethical Issues.** The seminar will be composed of students in approximately equal number from the Medical, Divinity, and Law Schools and will explore important medical, legal, and ethical features of current issues, e.g., transplantation, euthanasia, abortion. Faculty and resource persons from all three schools will participate in the seminar. Up to four introductory sessions in the fall semester for all participating students and faculty will be concluded with arrangement of interdisciplinary terms and selected topics. Student teams will meet during the winter and consult at intervals with faculty. All semester participants will re-assemble for a series of weekly meetings ending in mid-March to present and discuss the topics researched. Any topics properly focused may be considered. Course covers fall section 82 and spring section 81. If permitted by instructor, this course can be audited. Weight: 2. Max: 6. *Gianturco (Medical), Shimm (Law), Smith (Divinity) and other faculty members from all three schools*

## **Special Interdisciplinary Training Programs**

### **BEHAVIORAL NEUROSCIENCES STUDY PROGRAM (BSP)**

PROGRAM DIRECTOR: Dr. Everett H. Ellinwood

This study program is designed to help third year medical students obtain an integrative understanding of the basic processes underlying normal and pathological human and laboratory animal behavior. The course and preceptorship offerings familiarize students with significant developments in the behavioral neurosciences, investigative methodology used to examine human behavior and its neurobiological underpinnings, and the application of these findings to medicine. As an example, they are provided with the neuroanatomical, histochemical, neuroimmunological, neuropharmacological, and neurobehavioral basis of prescribing anxiolytics, antidepressants, and other neurotropic drugs.



Students are encouraged to select an area of research concentration and then arrange to match their interests with a faculty member as a research preceptor by discussing the array of options with the study program director. They are given the opportunity to focus on some determinant of human behavior which may include neurobiological, developmental, or psychosocial factors. Students may choose to spend a significant portion of their time in a closely supervised laboratory with associated library research in an area of the student's interest resulting in a published report of the work. Specific science interests can be augmented through seminars, guided readings, and appropriate courses providing a greater familiarity with current issues in the biobehavioral sciences. The following course work is required of all students: PSC-223B Neurobehavioral Basis of Behavior.

The courses listed below, although not required, are recommended for consideration:

PSC-360B. Neuropharmacology  
PHR-372B. Cellular Endocrinology  
NBI-270B. Neurobiology  
PSC-213B. Human Development I. Birth through Adolescence  
PSC-215B. Comparative Personality Theory

Alternatives to the intensive laboratory research concentration are also offered. In addition to courses in the Department of Psychiatry, students may take courses offered through the Medical and Graduate Schools.

FACULTY:: Garth Bissette, Ph.D.; James Blumenthal, Ph.D.; Everett H. Ellinwood, Jr., M.D.; Linda K. George, Ph.D.; Jau-Shyong Hong, Ph.D.; K. Ranga Krishnan, M.B.B.S.; Cynthia M. Kuhn, Ph.D.; James E. Lee, M.D.; Edward D. Levin, Ph.D.; David J. Madden, Ph.D.; George L. Maddox, Ph.D.; Roy J. Mathew, M.B.B.S.; Jed E. Rose, Ph.D.; Saul M. Schanberg, M.D., Ph.D.; Susan S. Schiffman, Ph.D.; Rochelle D. Schwartz, Ph.D.; Richard S. Surwit, Ph.D.; Richard D. Weiner, M.D., Ph.D.; Redford B. Williams, M.D.

## **BIOMEDICAL ENGINEERING STUDY PROGRAM (BES)**

PROGRAM DIRECTORS: Peter K. Smith, M.D. and James H. McElhaney, Ph.D.

This interdepartmental study program is designed to provide third year students with an opportunity to perform basic science research in the broad area of biomedical engineering. The program is designed to provide research opportunities to students interested in the quantitative understanding of the physiology of organs and organ systems. The majority of the faculty have research laboratories which investigate these areas at the macroscopic level. The course of study usually emphasizes either the employment of whole animal models or in vitro simulation of disease states. The development and employment of new instrumentation may be a component of the research effort, but not its exclusive objective. Emphasis in the student experience is placed upon the teaching of the quantitative method of understanding biological systems. The student is expected to learn to formulate hypotheses regarding biologic systems, develop appropriate methods to test such hypotheses, and use statistical methods to resolve the information obtained. Each student selects a faculty preceptor in consultation with the program director(s) and an individual research plan is developed. Students who wish to enter this program are not required to have an engineering background.

FACULTY: Roger C. Barr, Ph.D.; Robert D. Fitch, M.D.; John A. Feagin, M.D.; William E. Garrett, M.D., Ph.D.; Donald D. Glower, M.D.; Bruce M. Klitzman, Ph.D.; Bruce J. Leone, M.D.; L. Scott Levin, M.D.; James E. Lowe, M.D.; James H. McElhaney, Ph.D.; Barry S. Myers, M.D., Ph.D.; Ares D. Pasipoularides, M.D., Ph.D.; Robert Plonsey, Ph.D.; Debra A. Schwinn, M.D.; Peter K. Smith, M.D.; William M. Smith, Ph.D.; Paul V. Suhocki, M.D.; George A. Truskey, Ph.D.; Ross M. Ungerleider, M.D.; James R. Urbaniak, M.D.; Peter Van Trigt, III, M.D.; Olaf T. von Ramm, Ph.D.

## **BIOMETRY AND MEDICAL INFORMATICS STUDY PROGRAM (BMS)**

PROGRAM DIRECTOR: Dr. William E. Wilkinson

This study program offers students the opportunity to explore, in the context of a biomedical application, one or more of the basic disciplines by which data are collected,



stored and analyzed, hypotheses are constructed, and knowledge is integrated. These core disciplines include: biostatistics, database methods, decision theory, epidemiology, modeling, simulation, artificial intelligence, and systems development. The emphasis, therefore, is on study and research into the methodological principles of biometry and medical informatics which are involved in biomedical problem-solving situations rather than on the area of biomedical science in which the application occurs.

Because of the multidisciplinary nature of this program, a student may either select a preceptor from one of the core biometry and medical informatics laboratories or two faculty preceptors. (In the latter case, a discipline preceptor has a background in biometry, medical informatics, or epidemiology; an applications preceptor has a background in a medical basic science or a clinical science area and is involved with a project utilizing one of the disciplines that constitute biometry and medical informatics.) The student, together with the faculty preceptors, designs an appropriate study plan which concentrates on one or two core disciplines. This plan consists of the following three components.

*Individual research project:* Under the supervision of the discipline and applications preceptors, students participate in an individual research experience which constitutes the major component of the study program. This experience is structured to provide an in-depth exposure to the use of techniques from the core discipline to address a real world biomedical problem.

*An overview seminar* exposes each student to the vocabulary and the basic principles and concepts of each of the core disciplines. In addition to this required course, each student is expected to acquire some depth of knowledge in the core disciplines chosen for concentration through a selection of two or three *discipline-specific courses*:

- BMI-211B. Probability and Statistical Inference
- BMI-212B. Design of Etiological, Clinical, and Experimental Studies
- BMI-213B. Research Data Management and Statistical Computing
- BMI-217B. Clinical Decision Analysis
- BMI-221B. Statistical Methods in Human Genetics
- BMI-233B. Biomedical Uses of Computers
- BMI-234B. Artificial Intelligence in Medicine
- CFM-240B. Epidemiologic Methods in Primary Care Research
- CPS -241. Data Base Methodology

Throughout the year, students and faculty members meet regularly to review ongoing research in the core disciplines. Students are expected to present their work in this context as a means of developing presentation skills and obtaining input from investigators who are not directly involved in their project.

*Applications Preceptors:* Any faculty member with an appointment in a Medical Center department and a laboratory involving applications of biometry and medical informatics can be an applications preceptor.

FACULTY: Scott R. Brazer, M.D., M.H.S.; W. Eugene Broadhead, M.D., Ph.D.; Robert M. Califf, M.D.; Deborah V. Dawson, Ph.D.; Elizabeth R. DeLong, Ph.D.; David T. Durack, M.D., D. Phil.; W. Edward Hammond, Ph.D.; Frank E. Harrell, Jr., Ph.D.; Kerry L. Lee, Ph.D.; Lawrence H. Muhlbauer, Ph.D.; Edward L. C. Pritchett, M.D.; David B. Pryor, M.D.; L. Richard Smith, Ph.D.; Galen S. Wagner, M.D.; William E. Wilkinson, Ph.D.

## **BIOPHYSICS STUDY PROGRAM (BPP)**

PROGRAM DIRECTOR: Dr. G. Allan Johnson

This interdepartmental program provides an opportunity for medical students in the elective year to participate in research areas of basic and clinical medicine where quantitative and engineering methods are employed. The range of subject material included in the program is broad, ranging from the development of instrumentation to theoretical studies on chemical and physical mechanisms in biomedical systems. Some example areas are the development and application of new imaging techniques and the

application of computer simulation to the study of biochemical and physiological systems.

Each student selects a faculty preceptor in consultation with the program directors and designs an individual plan in cooperation with the preceptor and directors. The primary emphasis of each student's plan is expected to be research. Students may, however, also be advised to take an existing course or to set up a tutorial with a faculty member to fill in deficient areas or to acquire needed quantitative or engineering skills. Depending on the subject area selected, a student may initiate a new research project of limited scope or take over a well-defined part of an existing project. Students are expected to produce some form of written summary of their work, possibly (but not necessarily) a paper suitable for publication in a scientific journal.

Students taking this program should have some prior training or experience in one or more of the following areas: mathematics, computer science, physics, chemistry, or engineering (electrical, mechanical, biomedical, etc.).

**FACULTY:** H. Cecil Charles, Ph.D.; Mark W. Dewhirst, D.V.M., Ph.D.; James T. Dobbins III, Ph.D.; Carey E. Floyd, Ph.D.; Laurence W. Hedlund, Ph.D.; Ronald J. Jaszczak, Ph.D.; Randy L. Jirtle, Ph.D.; G. Allan Johnson, Ph.D.; James R. MacFall, Ph.D.; James R. Oleson, M.D., Ph.D.; H. Dirk Sostman, M.D.; Leonard D. Spicer, Ph.D.; Michael R. Zalutsky, Ph.D.

### **CANCER BIOLOGY STUDY PROGRAM (CBP)**

**PROGRAM DIRECTORS:** Dr. Edward C. Halperin and Dr. Jonathan M. Horowitz

The Cancer Biology Study Program offers third year medical students a thirty-two credit program of basic science instruction. Each student has an opportunity to focus on an area of interest and pursue a scholarly activity. Through a combination of research preceptorship and classroom work, students are introduced to cancer research. The students may choose to investigate oncogenes, tumor suppressor genes, growth factors, chromosomal abnormalities, cellular invasion and metastases, tumor doubling time, cell loss, tumor hypoxia, tumor angiogenesis, chemical/radiation/foreign body/viral/tobacco carcinogenesis, biologic and immunotherapy principles, radiobiology and hyperthermic oncology, and the pharmacology of cancer chemotherapy.

All students are required to take RON-228B, "The Basic Science of Oncology," during the fall semester. In the spring semester, students are required to take Tutorial in Cancer Biology. In this one credit seminar, students review selected topics in cancer biology. The remaining twenty-eight credits are earned through CBP-301B, Research in Cancer Biology.

Students meet individually and regularly with the program director to discuss progress in the study program and review problems. The program director meets regularly with preceptors to discuss the progress of students. All students have an exit interview to ascertain the strong and weak parts of the program in order to find ways of improving the program for the subsequent group of students.

**FACULTY:** Robert C. Bast, Jr., M.D.; Robert M. Bell, Ph.D.; Andrew Berchuck, M.D.; Patrick J. Casey, Ph.D.; Mark W. Dewhirst, D.V.M., Ph.D.; Henry S. Friedman, M.D.; Stephen Garrett, Ph.D.; Yusuf A. Hannun, M.D.; Randy L. Jirtle, Ph.D.; Joanne Kurtzberg, M.D.; Jeffrey R. Marks, Ph.D.; Lawrence Marks, M.D.; Joseph R. Nevins, Ph.D.; Michael C. Ostrowski, Ph.D.; Salvatore V. Pizzo, M.D., Ph.D.; Hilliard F. Seigler, M.D.

### **CARDIOVASCULAR STUDY PROGRAM (CVS)**

**PROGRAM DIRECTOR:** Harold C. Strauss, M.D.

This interdepartmental study program is designed to provide third year medical students with an in-depth basic science research experience in one area of the broad discipline of cardiovascular science. The program is directed at those students potentially interested in a career in cardiovascular research. Faculty members in this study tract come from numerous departments including biochemistry, cell biology, immunology, pathology, and pharmacology. Students who elect this study program undertake a research project in a laboratory under the guidance of a faculty preceptor. In addition,



students are encouraged to take course work each term to complement their research interests. Because a wide range of research opportunities is available, course work is individually tailored by the faculty preceptor to the interests of the student.

**FACULTY:** Page A. W. Anderson, M.D.; Robert M. Bell, Ph.D.; G. Vann Bennett, M.D., Ph.D.; Perry J. Blackshear, M.D., Ph.D.; Marc G. Caron, Ph.D.; Frederick R. Cobb, M.D.; Samuel E. George, M.D.; Augustus O. Grant, M.B., Ch.B.; Joseph C. Greenfield, Jr., M.D.; Diane L. Hatchell, Ph.D.; Barton F. Haynes, M.D.; Raymond E. Ideker, M.D., Ph.D.; Bruce M. Klitzman, Ph.D.; William E. Kraus, M.D.; Robert J. Lefkowitz, M.D.; Ann LeFurgey, Ph.D.; Melvyn Lieberman, Ph.D.; Anthony R. Means, Ph.D.; Claude A. Piantadosi, M.D.; Keith A. Reimer, M.D., Ph.D.; Debra A. Schwinn, M.D.; C. Frank Starmer, Ph.D.; Gary L. Stiles, M.D.; Harold C. Strauss, M.D.; Antonius M. J. VanDongen, Ph.D.; Xiao-Fan Wang, Ph.D.; A. Richard Whorton, Ph.D.

## **CELL AND REGULATORY BIOLOGY STUDY PROGRAM (CRB)**

**PROGRAM DIRECTORS:** Dr. George M. Padilla and Dr. Steven R. Vigna

The CRB program is based on the application of contemporary experimental approaches of cell biology and genetics to the study of regulatory mechanisms in health and disease. It seeks to bridge the gap between research at the cellular/molecular and the tissue/organ level of organization.

Research areas represented in the CRB program fall into four broad categories:

*Molecular properties and actions of peptide hormones, growth factors and their receptors.* This category includes studies on membrane biology, ligand-receptor interactions, and signal transduction; molecular mechanisms of insulin action and related growth factors (EGF and PDGF); and mechanisms of action of regulatory peptides on gastrointestinal target organs.

*Genetic and biochemical regulation of membrane function, cytoskeletal elements, intracellular motility, and macromolecular trafficking.* In this category are studies on the motor complexes which drive organelle movements within cells during endocytosis, exocytosis, and axonal transport; intracellular function of unconventional myosins encoded by *abm* genes; and regulation of nucleocytoplasmic trafficking.

*Genetic regulation of cell proliferation, growth, and development.* Research in this category includes the biochemical and functional properties of the recessive retinoblastoma oncogene; hormonal regulation of malignant cell growth; the molecular basis of cytokinesis; the role of fetal and placental hormones in the regulation of fetal growth and oogenesis; molecular basis of morphogenetic changes using genetic and transgenic methods; and the role of cyclins in mitotic and meiotic events in relation to cell cycle specific kinases.

*Regulation of integrated physiological processes.* In this category are investigations on the role of atrial natriuretic factors in blood volume and arterial pressure regulation; the role of intracellular second messengers in ionic and metabolic regulation; regulation of chloride channels in epithelial cells; regulatory mechanisms of tissue oxygen concentration and oxidant damage; organization and control of intermediary metabolism pathways; neural regulation of gonadotropin function; and genetic regulation of intermediary metabolism in response to metabolic demands on striated muscle (myocytes).

The major emphasis of the CRB program is on student-generated, independent study/research projects conducted in a close association with a faculty preceptor. Students are encouraged to enroll in basic science courses or relevant clinical offerings which contribute to their research projects or their future career goals. The research colloquia and self-learning course offerings, as described below, are equally important components of the CRB program.

For all students, the program consists of the following:

*Individual Tutorial (CBI-219).* This is carried out under the supervision of a faculty preceptor selected by each student with the approval of the program directors. Students are expected to complete their tutorial arrangements before entering the program. The



program directors direct the students to appropriate faculty preceptors and evaluate the proposed research projects.

*Topics in Cell and Regulatory Biology (CBI-220).* Basic science principles and their application to clinical situations are considered in this course. Focus is on integrated analyses of regulatory mechanisms from the cellular to the organ levels of organization. Faculty led seminars are held at weekly intervals in the fall and spring to consider topics which reflect the research interests of the CRB participants.

*Self-Learning Activities.* The CRB Program is designed to permit students to participate in self-study activities that contribute to their immediate and long-term medical career needs. The program directors assist students in designing individual study/research programs to fulfill their academic goals in accordance to the rules and regulations of the elective third year.

*Colloquia and Research Presentations.* An important component of this program is a series of research colloquia scheduled through the academic year. At the beginning of the fall semester, students give a brief presentation on their proposed research to the CRB participants. This presentation and a short research report is a formal requirement of all participants. Toward the end of spring semester, students present their research results before the group in the form of a platform presentation.

*Research Reports.* Coincident with the research colloquia, students are required to submit two written reports to the program directors on their research projects. The preliminary report is submitted before the end of the fall semester. It consists of a brief review of the literature, a discussion of the hypothesis to be tested, specific aims of the proposed research, and a brief assessment and justification of the methodologies that are to be employed. A midyear grade is based on the initial research colloquium and preliminary report. The final report, submitted towards the end of the spring semester, is written in the form of a research paper being submitted for publication. It should include a more extensive review of the literature and an evaluation and discussion of the results obtained. The colloquia and research reports provide an opportunity for medical students to develop communication and presentation skills for their biomedical careers.

**FACULTY:** Onyekwere E. Akwari, M.D.; Nels C. Anderson, Jr., Ph.D.; Bruce A. Benjamin, Ph.D.; Peter B. Bennett, Ph.D., D.Sc.; Perry J. Blackshear, M.D., D.Phil.; J. Joseph Blum, Ph.D.; Nancy L. Bossert, Ph.D.; Andrew T. Canada, Jr., Ph.D.; Marc G. Caron, Ph.D.; Jonathan A. Cohn, M.D.; Laura I. Davis, Ph.D.; Arturo De Lozanne, Ph.D.; William Dittman, M.D.; Marc K. Drezner, M.D.; J. Gregory Fitz, M.D.; Michael Freemark, M.D.; William E. Garrett, M.D., Ph.D.; Thomas W. Gettys, Ph.D.; Yusuf A. Hannun, M.D.; Jonathan M. Horowitz, Ph.D.; Claude L. Hughes, M.D., Ph.D.; James D. Iglehart, M.D.; Daniel P. Kiehart, Ph.D.; William E. Kraus, M.D.; Cynthia M. Kuhn, Ph.D.; Rodger A. Liddle, M.D.; Kenneth S. McCarty, Sr., Ph.D.; Tobias Meyer, Ph.D.; Theresa O'Halloran, Ph.D.; George Padilla, Ph.D.; Patricia Saling, Ph.D.; David W. Schomberg, Ph.D.; Michael P. Sheetz, Ph.D.; Shirish Shenolikar, Ph.D.; Bryant W. Stolp, M.D., Ph.D.; Katherine I. Swenson, Ph.D.; Ian L. Taylor, M.D., Ph.D.; Margaret Titus, Ph.D.; E. Lee Tyrey, Ph.D.; Steven R. Vigna, Ph.D.; David K. Walmer, M.D., Ph.D.; Jo Rae Wright, Ph.D.

## **EPIDEMIOLOGY, HEALTH SERVICES, AND HEALTH POLICY STUDY PROGRAM (EHS)**

**LABORATORY DIRECTORS:** Dan G. Blazer, M.D., Ph.D. and Arthur T. Garson, Jr., M.D., M.P.H.

With increased emphasis on the true outcomes of clinical care, there is a gap in the training of physicians to meet the following goals: (a) physician-researchers who initiate studies to determine the optimal clinical practice and the optimal uses of expensive technology, and (b) providers of data to research studies and the need to understand the appropriate data-collection procedures as well as the fit of the data into the overall picture of clinical research and care of the patient.

The Epidemiology, Health Services, and Health Policy Study Program is designed to provide knowledge regarding research tools to third year Duke medical students to design prospective clinical trials and to analyze the emerging health services research data. Participants also learn the essentials of health policy and comparative health

systems so that they can be contributors to the improvement of the system of health care, beginning with the improved health of the patient but extending to local, state, and national issues.

## **Program Overview**

After satisfactory completion of the courses, practicum, and independent research detailed below, participants in the Epidemiology, Health Services, and Health Policy Study Program are granted a total of thirty-two basic science credits for their work. Students in this program may also work toward a master's degree in Health Policy, but this requires an entire year of study.

*Courses.* The EHS Study Program intends to offer courses in the areas listed below. Two courses are required: Introduction to Epidemiology and Introduction to Health Care Policy Analysis. Other electives may be substituted with the approval of the program director. Third-year students in other study programs may elect to take the courses listed if space is available and permission is given by their third-year mentors.

Proposed courses:

Introduction to Epidemiology

Introduction to Health Care Policy Analysis

Descriptive and Analytic Statistics

Study Design, Data Collection and Analyses, Risk Factors, and Prevention

Health Services Research: Assessment of Health, Practice Variation, Practice Guidelines

Health Care Finance

Health Care Systems: Hospitals, States and Nations

*Practicum.* Each student works in an Epidemiology/Health Services/Health Policy independent research activity (e.g., state funding program office, medical center business office, or designing outcomes studies). This occupies at least 25 percent of the student's time throughout the nine months.

*Required Research.* In conjunction with the practicum, each student is required to produce an in-depth research paper analyzing an area of epidemiology, health services research, finance, health systems, or health policy, most probably related to the student's Practicum experience. He or she works with an advisor to determine and investigate the topic. This research activity extends throughout the nine months, culminating with the acceptance of the completed paper.

FACULTY: Dan G. Blazer, M.D., Ph.D.; John R. Feussner, M.D.; Linda K. George, Ph.D.; George L. Maddox, Ph.D.; David B. Matchar, M.D.; Morris Weinberger, Ph.D.; William E. Wilkinson, Ph.D.

## **IMMUNOLOGY STUDY PROGRAM (ISP)**

PROGRAM DIRECTOR: Dr. Frances E. Ward

This program is designed for students whose career goals lie in one of the many clinical specialties that interface broadly with immunology, allergy-immunology, infectious diseases, rheumatology, hematology, transplantation, and oncology. A basic but thorough introduction to immunology is developed in IMM 291B, which also emphasizes critical discussion of original research papers. A further and more clinically oriented analysis is provided in the core course IMM 330B, Medical Immunology, which emphasizes the role of immunologic mechanisms in various human disease states. Each student chooses a faculty preceptor with whom to work on an original research project. It is encouraged that the student not be merely injected into the continuum of the preceptor's research interests, but rather that an individual project be developed which can be completed during the study program. The primary goals of the program are to encourage and develop the student's own creativity, to expose him or her to the research interests and philosophies of the entire Department of Immunology, and to help gain a useful personal perspective on current immunologic thought with an emphasis on clinical relevance. The student's efforts and time are generally divided as follows:



*Preceptorship.* The major emphasis of the program during which the students function much as graduate students in the Department of Immunology. (30 hours or more per week).

*Comprehensive Immunology (IMM-291B).* An in-depth course in the basic concepts of immunology. Analysis of antigens and antibodies is followed by an emphasis on the organization and cellular and molecular aspects of the immune system, its regulation, and effector mechanisms. (4 hours per week, fall term).

*Medical Immunology (IMM-330B).* A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable, the classes include patient presentations and laboratory demonstrations. The course meets daily permitting each disease state to be covered in considerable depth. (5 hours per week, spring term).

*Seminars for Research Progress.* Throughout the year, fellows and students in the department present brief informal seminars on their ongoing research. The discussion that follows is of great help to the presenter and allows the student to observe and participate in critical analysis of research before it is at the publication or formal seminar stage. (1 hour per week).

*Immunology Department Seminars.* A series of formal seminars by department faculty and visiting scientists. (1-2 hours per week).

*Additional Course Work.* The student may elect to take any of several courses in immunology and related fields but is generally discouraged from excessively diluting his laboratory experience.

**FACULTY:** Yair Argon, Ph.D.; Andrew E. Balber, Ph.D.; Robert C. Bast, Jr., M.D.; R. Randal Bollinger, M.D., Ph.D.; Dani P. Bolognesi, Ph.D.; Rebecca H. Buckley, M.D.; Ronald B. Corley, Ph.D.; Jeffrey R. Dawson, Ph.D.; Carolyn Doyle, Ph.D.; Russell P. Hall, M.D.; Barton F. Haynes, M.D.; Donna D. Kostyu, Ph.D.; Michael Krangel, Ph.D.; Joanne Kurtzberg, M.D.; M. Louise Markert, M.D., Ph.D.; Thomas J. Palker, M.D.; David S. Pisetsky, M.D., Ph.D.; William J. Richtsmeier, M.D., Ph.D.; Wendell Rosse, M.D.; Hilliard F. Seigler, M.D.; Michael F. Seldin, M.D., Ph.D.; Ralph Snyderman, M.D.; Thomas F. Tedder, Ph.D.; Frances E. Ward, Ph.D.

## **INFECTIOUS DISEASES STUDY PROGRAM (IDP)**

**PROGRAM DIRECTOR:** Dr. Thomas G. Mitchell

Knowledge of infectious diseases is relevant to care of patients of all ages and in each clinical specialty from surgery, pediatrics, and medicine to obstetrics-gynecology and family medicine. This study program is designed to provide students with the opportunity to directly explore infectious diseases in a laboratory setting coupled with lecture/seminar courses designed to provide some breadth of knowledge of the host, microorganism, and their interactions. The goals of the program are to instill a critical assessment of information, to provide the opportunity for creative acquisition of data, to encourage independent thinking, and to provide insight into modern technology and the interrelationship of clinical infectious diseases with basic microbiology and immunology.

Each student selects a faculty preceptor with whom to work on an original research project. The student is expected to develop her or his own project within the framework of an existing laboratory, but designs her or his own experiments, critically assesses the relevant literature, learns to evaluate data, and has the opportunity to solve the problems associated with the project. Appropriate guidance and assistance is provided by the faculty and others within the laboratory setting.

*Preceptorship.* This is the major emphasis of the program with students functioning essentially as graduate students. 30 hours or more per week.

*Courses.* During the fall term, students are required to take one course, Principles of Infectious Disease (MIC-301B). This course provides discussion of the basic biology of



a broad spectrum of microorganisms, the diseases they cause, and the host response to these infections. The first eight weeks of the term are devoted to bacterial and mycotic infections and are organized by organ system. In the second eight weeks, viral diseases are presented ranging from intrauterine infections to oncogenes. During the spring term, students are required to take either Medical Immunology (MIC-330B) or Virology and Viral Oncology (MIC-252B), the selection being determined by the student's laboratory research interests.

*Seminars.* Students in the Infectious Diseases Study Program attend a weekly seminar in which faculty members, fellows, and students present their ongoing research. Such presentations enable the student to observe and participate in critical analysis of research before it reaches the publication stage.

*Additional Course Work.* Although other basic science electives in microbiology and immunology may be taken upon approval by the program director, the student is discouraged from excessively diluting her or his laboratory experience.

**FACULTY:** Andrew E. Balber, Ph.D.; Dani P. Bolognesi, Ph.D.; Rebecca H. Buckley, M.D.; Vickers Burdett, Ph.D.; Bryan R. Cullen, Ph.D.; Mariano A. Garcia-Blanco, M.D., Ph.D.; Donald L. Granger, M.D.; John D. Hamilton, M.D.; Jonathan M. Horowitz, Ph.D.; Wolfgang K. Joklik, D.Phil.; Jack D. Keene, Ph.D.; Kenneth Kreuzer, Ph.D.; Roger J. Kurlander, M.D.; Thomas G. Mitchell, Ph.D.; Joseph R. Nevins, Ph.D.; John R. Perfect, M.D.; David J. Pickup, Ph.D.; Daniel J. Sexton, M.D.; J. Brice Weinberg, M.D.; Kenneth H. Wilson, M.D.

## **MOLECULAR AND CELLULAR BASIS OF DIFFERENTIATION STUDY PROGRAM (MCD)**

**PROGRAM DIRECTORS:** Dr. Kenneth S. McCarty, Sr. and Dr. Sheila Counce

This study program is designed to provide an opportunity for third year medical students to spend a year interacting with a group of basic science faculty who utilize the concepts of molecular biology as applied to problems of differentiation. The primary objective is to present basic concepts including: (a) the organization and retrieval of genetic information; (b) hormonal regulation of gene expression; (c) relation of time, space, and pattern in developing systems; and (d) tissue interactions in morphogenesis and differentiation. The organization of genetic information includes evidence of the mechanism of gene amplification in development and drug resistance, recent concepts regarding enhancer modification of hormone response, and specific examples of hormone induced gene expression. The mechanism(s) involved in cell-cell and cell-matrix interactions in differentiation are reviewed. The following courses form the background subject material:

*BCH-320B. Cell Differentiation in Development and Disease.* This is an introduction to gene structure and information retrieval in eukaryotes. Chromosome organization and mRNA transcription is reviewed using cDNA probes to test a number of new concepts of chromosome inactivation, gene amplification, and the impact of nucleocytoplasmic interactions on the regulation of differentiation.

*BCH-321B. Hormone and Tissue Interactions in Differentiation and Disease.* Hormones and other biochemical signals involved in the regulation of the differentiated state are discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of chromatin. Cell-cell, cell-matrix, and hormonal interactions are considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix are discussed in terms of differentiation of limb bud, pancreas, lymphocyte, and neural tissue.

*Conferences.* Conferences include a critical examination of recent papers on hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases and are designed as an extension of the courses described above.

*Procedures.* Upon the selection of this program the directors assist students in selection of a mentor. After a discussion of the student's interests and expectations for the third year, the program directors suggest a number of possible mentors. After

meeting with potential mentors to determine a preliminary selection, a program director meets with both the student and the selected mentor to discuss the proposed research. In this selection it is suggested that students also confer with former students for suggestions. The student then prepares a brief written outline of the meeting with copies submitted to both the mentor and director. As the research progresses, the student presents a progress report in the form of an informal seminar to the members of the program. At the end of the year a final seminar and written report are presented and, hopefully, a poster is submitted to the AOA symposium.

**FACULTY:** Yair Argon, Ph.D.; Robert M. Bell, Ph.D.; G. Vann Bennett, M.D., Ph.D.; Patrick J. Casey, Ph.D.; Joseph M. Corless, M.D., Ph.D.; Sheila Counce, Ph.D.; Sharyn A. Endow, Ph.D.; Harold P. Erickson, Ph.D.; Carol A. Fierke, Ph.D.; Stephen Garrett, Ph.D.; Yusuf A. Hannun, M.D.; Michael S. Herschfield, M.D.; Edward W. Holmes, M.D.; Tao-Shih Hsieh, Ph.D.; Bernard Kaufman, Ph.D.; Nicholas M. Kredich, M.D.; Cynthia M. Kuhn, Ph.D.; Robert J. Lefkowitz, M.D.; Virginia A. Lightner, M.D., Ph.D.; Elwood A. Linney, Ph.D.; Kenneth S. McCarty, Jr., M.D., Ph.D.; Kenneth S. McCarty, Sr., Ph.D.; Paul L. Modrich, Ph.D.; Joseph R. Nevins, Ph.D.; Keith L. Parker, M.D., Ph.D.; David C. Richardson, Ph.D.; Jane S. Richardson; Patricia Saling, Ph.D.; Michael P. Sheetz, Ph.D.; Theodore A. Slotkin, Ph.D.; Leonard D. Spicer, Ph.D.; Deborah A. Steege, Ph.D.; Gary L. Stiles, M.D.; Margaret A. Titus, Ph.D.

## NEUROBIOLOGY STUDY PROGRAM (NBP)

**PROGRAM DIRECTOR:** Dr. Nell Beatty Cant

Through the Neurobiology Study Program, students may examine the nervous system at many levels. Areas of study include neuroanatomy, neurochemistry, neuropharmacology, neurophysiology, and developmental neurobiology as well as the neurobiology of a number of important diseases. Faculty in the study program are engaged in research that ranges from the molecular to the systems level. The program emphasizes a basic research experience or tutorial under the guidance of a preceptor, a bi-weekly research seminar, and the opportunity to audit appropriate neurobiology courses during the year.

*Research Experience.* The basic component of the NBP Study Program is an in-depth research experience in a basic science laboratory under the supervision of one of the participating faculty. Involvement in the research process can be at several levels. Most students wish to work full-time in a laboratory pursuing an independent research project, including an analysis of experiments and communication of the results. Students in this category who wish to attend courses are usually advised to audit them. Other students may wish to combine a part-time research experience with extensive course work. The appropriate level for each student should be determined in consultation with the study program director and the research mentor. All students are expected to prepare written statements of their goals for the year with a detailed plan for accomplishing these goals. This could take the form of stating the problem to be studied, the hypotheses, and an outline of the work to be done. A final report may take the form of a research paper or literature review. Publication is not required, but many students have been successful in publishing a report with their preceptors.

*Seminar.* Students enrolled in the program meet twice monthly with the program director for an informal seminar. In the beginning of the fall term, seminars focus on the planned projects of each student. At the end of the spring semester, the seminar focuses on work accomplished as each student presents a report of his or her research. During the rest of the year, invited speakers are asked to address particular topics of interest to be decided by the group.

**FACULTY:** George J. Augustine, Ph.D.; Jorge V. Bartolome, Ph.D.; Rose-Mary Boustany, M.D.; Nell Beatty Cant, Ph.D.; John H. Casseday, Ph.D.; Joseph M. Corless, M.D., Ph.D.; Gillian Einstein, Ph.D.; Robert P. Erickson, Ph.D.; David Fitzpatrick, Ph.D.; William C. Hall, Ph.D.; David A. Hosford, M.D., Ph.D.; Lawrence C. Katz, Ph.D.; Julie C. Kauer, Ph.D.; Cynthia M. Kuhn, Ph.D.; Anthony S. LaMantia, Ph.D.; Darrell V. Lewis, M.D.; Roger Madison, Ph.D.; William D. Matthew, Ph.D.; James O. McNamara, M.D.; J. Victor Nadler, Ph.D.; Dale Purves, M.D.; Allen D. Roses, M.D.; Saul M. Schanberg, M.D., Ph.D.; Donald E. Schmechel, M.D.; Rochelle D. Schwartz, Ph.D.; Sidney A. Simon, Ph.D.; J. H. Pate Skene, Ph.D.;



Theodore A. Slotkin, Ph.D.; George G. Somjen, M.D.; John Staddon, Ph.D.; Warren J. Strittmatter, M.D.; Dennis A. Turner, Ph.D.; E. Lee Tyrey, Ph.D.; Wilkie A. Wilson, Ph.D.; Fulton Wong, Ph.D.

**OPHTHALMOLOGY AND VISUAL SCIENCE STUDY PROGRAM (OVS)**

**PROGRAM DIRECTORS:** David L. Epstein, M.D. and Fulton Wong, Ph.D.

*Description.* The purpose of this study program is to provide third year Duke medical students with research skills and experience that can be applied to future careers as clinician scientists in ophthalmology and other fields. Although there is a primary emphasis on laboratory science, clinical research programs of inquiry based on strong scholarship are also possible. There is a true focus on clinical investigators forming a true partnership with basic science researchers in attempting to advance the understanding and therapy of ocular diseases. There is an emphasis on hypothesis formation and the planning and execution of experiments that can address and then redefine the hypothesis.

*Curriculum.* Each student chooses a preceptor according to her/his interests and together determine a topic of investigation which requires hands-on laboratory or clinical research by the student. Joint preceptors (for example, a clinical investigator and a basic science researcher) are acceptable and, in fact, encouraged. The course of study must be approved by the study program directors. At the end of the year, each student is expected to produce an in-depth paper based on the research. Throughout the year students attend (a) regular lectures on topics about ophthalmology and visual science given by Duke faculty as well as outside lecturers; (b) participate in bimonthly research workshops in which students and faculty make presentations of hypotheses, assumptions therein, methods and results, and (c) give formal presentations of research work at the conclusion of the year.

*Research Opportunities.* Opportunities include research in physiology, pathology, and molecular and cell biology of the eye as they relate to eye diseases. Opportunities also exist in biophysics and instrumentation, laser cell biology, and scientific basis of glaucoma, corneal, and retinal diseases.

**FACULTY:** R. Rand Allingham, M.D.; W. Banks Anderson, M.D.; Edward G. Buckley, M.D.; Joseph M. Corless, M.D., Ph.D.; Irving T. Diamond, Ph.D.; Jonathan J. Dutton, M.D., Ph.D.; Gillian Einstein, Ph.D.; David L. Epstein, M.D.; Gary N. Foulks, M.D.; W. Craig Fowler, M.D.; Diane L. Hatchell, Ph.D.; Glenn J. Jaffe, M.D.; Gordon Klintworth, M.D., Ph.D.; Robert Machemer, M.D.; Brooks W. McCuen, M.D.; Calvin H. Mitchell, M.D.; E. Timothy O'Brien, Ph.D.; Stephen C. Pollock, M.D.; Alan Proia, M.D., Ph.D.; Judy H. Seaber, Ph.D.; M. Bruce Shields, M.D.; Fulton Wong, Ph.D.

**PATHOLOGY STUDY PROGRAM (PSP)**

**PROGRAM DIRECTORS:** Dr. William D. Bradford (Coordinating Director), Dr. Keith A. Reimer and Dr. Maureane R. Hoffman

Pathology is the study of disease through the utilization of structural and functional changes to gain information about the human organism's response to injury. The goal of the Pathology Study Program is to provide the medical student with a thorough learning experience in the anatomical basis of disease under the guidance of a senior faculty preceptor. The essential elements of this program are: (a) organized course work; (b) independent, but guided research experience (bench or library); and (c) active participation in small group seminars.

To meet the diverse interests and needs of Duke medical students, there are three tracks within the Pathology Study Program. All curriculum plans must be approved and signed by Dr. Bradford prior to registration.

**PSP Track I**

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); student seminars
Elective Courses:	None
Independent Study:	Research with project report
Advisor:	Dr. Keith A. Reimer (684-3659)
Max number students:	10



## **PSP Track II**

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); autopsy, surgical, or cytopathology rotation (PTH 223B, PTH 348B, PTH 281B); student seminars
Elective Courses:	Limited
Independent Study:	Bench or library project
Advisor:	Dr. Maureane R. Hoffman (684-6925)
Max number students:	10

## **PSP Track III**

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); student seminars; autopsy, surgical or cytopathology rotation (PTH 223B, PTH 348B, PTH 281B)
Elective Courses:	A carefully planned selection of courses in a single area, e.g., molecular pathology, cardiovascular, neuropathology, etc., selected with the advice of a preceptor
Independent Study:	Tutorial library project to supplement course work
Advisor:	Dr. William Bradford (684-5112)
Max number students:	2 (by special arrangement)

## **Advisory Plan for Pathology Study Program**

The Department of Pathology participates in the Medical School orientation to the third year. Following the general information session, interested students may meet with advisors to establish interviews for individual mentors. Every student must have a study program advisor and an individual mentor. The curriculum plan, academic schedule, and registration cards of each student selected for the Pathology Study Program must be reviewed and approved by Dr. Bradford prior to registration.

**FACULTY:** Dolph O. Adams, M.D., Ph.D.; Darell D. Bigner, M.D., Ph.D.; Sandra H. Bigner, M.D.; Edward H. Bossen, M.D.; William D. Bradford, M.D.; Stephen J. Bredehoeft, M.D.; Dennis A. Clements, M.D., Ph.D.; James D. Crapo, M.D.; Stephen M. Denning, M.D.; Mark W. Dewhirst, D.V.M., Ph.D.; William A. Dittman, M.D.; John A. Feagin, Jr., M.D.; Thomas W. Gettys, Ph.D.; Marcia R. Gottfried, M.D.; Charles S. Greenberg, M.D.; Maureane R. Hoffman, M.D., Ph.D.; David Howell, M.D., Ph.D.; Raymond E. Ideker, M.D., Ph.D.; Peter D. Issitt, Ph.D.; Robert B. Jennings, M.D.; Randy L. Jirtle, Ph.D.; William W. Johnston, M.D.; Hideko Kamino, M.D.; William H. Kane, M.D., Ph.D.; Gordon Klintworth, M.D., Ph.D.; Roger J. Kurlander, M.D.; Lester Layfield, M.D.; Richard M. Levenson, M.D.; James E. Lowe, M.D.; Herbert K. Lyerly, M.D.; Neil R. MacIntyre, M.D.; Sara E. Miller, Ph.D.; Arthur Morris, M.D.; Salvatore V. Pizzo, M.D., Ph.D.; Alan D. Proia, M.D., Ph.D.; Howard Ratech, M.D.; Keith A. Reimer, M.D., Ph.D.; L. Barth Reller, M.D.; Victor L. Roggli, M.D.; Wendell F. Rosse, M.D.; Frank Sedor, Ph.D.; John D. Shelburne, M.D., Ph.D.; Joachim R. Sommer, M.D.; Charles Steenbergen, M.D., Ph.D.; John G. Toffaletti, Ph.D.; Robin T. Vollmer, M.D.; Philip J. Walther, M.D., Ph.D.; J. Brice Weinberg, M.D.; Frances K. Widmann, M.D.; Peter Zwadyk Jr., Ph.D.

## ROSTER OF HOUSE STAFF BY DEPARTMENTS

### Anesthesiology

Chief Residents 1994-1995: Scott T. Howell, M.D. (Duke, 1986); Nancy W. Knudsen, M.D. (Missouri, 1991); Robin H. Patty, M.D. (Duke, 1991).

Senior Residents: Elliott Bennet Guerrero, M.D. (Harvard, 1991); Donna Boyd, M.D. (California at San Diego, 1991); James A. Calabrese, M.D. (New York at Stony Brook, 1991); John Castellano, M.D. (Eastern Virginia, 1985); Daniel P. Gianturco, M.D. (North Carolina at Chapel Hill, 1991); Josef P. Grabmayer, M.D. (New York Health Sciences Center, 1991); Francisco Grinberg, M.D. (National Autonomous Univ. of Mexico, 1978); Scott T. Howell, M.D. (Duke, 1986); William T. H. Jones, M.D. (Med. Univ. of South Carolina, 1991); Laurie Jordan, M.D. (North Carolina at Chapel Hill, 1991); Nancy W. Knudsen, M.D. (Missouri, 1991); David C. Nauss, M.D. (Temple, 1991); Robin H. Patty, M.D. (Duke, 1991); Vincent Phillips, M.D. (North Carolina at Chapel Hill, 1991); Mark Raccasi, M.D. (Texas at Houston, 1991); Michael D. Sebastian, M.D. (Louisiana, 1987); Pamela Thomas-King, M.D. (Wisconsin, 1989); Verna Yancy, M.D. (California at Los Angeles, 1991).

Junior Residents: Jonathan Bennie, M.D. (Tennessee, 1992); Helene Benveniste, M.D. (Univ. of Copenhagen, 1986), Ph.D. (Univ. of Copenhagen, 1991); Stuart Cohen, M.D. (UMDNJ Robert Wood Johnson, 1992); Steven Dentz, M.D. (Michigan); Susan Drelich, M.D. (Tufts); John Eck, M.D. (Duke, 1992); Adam Edlund, M.D. (Michigan, 1992); Forest Evans, M.D. (South Carolina); Anne Marie Fras, M.D. (Michigan); Karl Fritz, M.D. (UMDNJ Robert Wood Johnson, 1992); Mark Gerhardt, M.D. (Michigan); John Haasis, M.D. (Med. Coll. of Pennsylvania, 1992); Albert Hasson, M.D. (University of Washington); Timothy Heine, M.D. (Louisville, 1988); Robert Hibbard, M.D. (Utah, 1992); Steven Hill, M.D. (Vanderbilt); Elizabeth Hollenback, M.D. (Chicago); Jon Jimenez, M.D. (Washington); Stephen Klein, M.D. (UMDNJ Robert Wood Johnson, 1992); Darryl Malak, M.D. (Loyola, 1992); Shantha McKinlay, M.D. (Med. Coll. of Pennsylvania, 1991); Eugene Moretti, M.D. (Temple); Taofeeq Nurudeen, M.D. (Morehouse, 1992); Ronald Osborn, M.D. (Texas at Houston, 1992); Mark Phillips, M.D. (Bowman Gray); Jennifer Root, M.D. (Alabama); Jonathan Sorohan, M.D. (Med. Coll. of Georgia, 1992); Clay Stanley, M.D. (Baylor, 1990); Robert Strehlow, M.D. (Texas at Southwestern); Glenn T. Wheaton, M.D. (Tennessee); Janis Zimmerman, M.D. (Med. Coll. of Ohio).

### Community and Family Medicine

Chief Residents: Brigitta T. Stengele, M.D. (Germany, 1989); Mignon F. Benjamin, M.D. (Rochester, 1991); Michael J. Hovan, M.D. (Colorado, 1990); William K. Joyner, M.D. (Jefferson, 1992); Kathy S. Robinson, M.D. (North Carolina at Chapel Hill, 1989).

Residents: David P. Adams, M.D. (North Carolina at Chapel Hill, 1992); Paul V. Aitken, Jr., M.D. (New York at Buffalo, 1992); Scott A. Anderson, M.D. (Wayne State, 1993); Grace Ayscue, M.D. (North Carolina at Chapel Hill, 1994); Yuri Bermudez, M.D. (Nicaragua, 1991); Miriam Bettencourt, M.D. (Brazil, 1989); Deanna Branscom, M.D. (Virginia, 1994); Lelin Chao, M.D. (New York Med. Coll., 1993); Kristina Disbrow, M.D. (Albany, 1994); Corinne Griffith, M.D. (Virginia, 1993); Josephine Harter, M.D. (Michigan, 1994); Michele I. Hensley, M.D. (Duke, 1982); Ronald W. Jarl, M.D. (New Jersey, 1991); Terence P. Loneragan, M.D. (New Jersey, 1993); Chris P. Mertes, M.D. (Northwestern, 1993); Timothy A. O'Donnell, M.D. (Ohio, 1993); David M. Quillen, M.D. (North Carolina at Chapel Hill, 1992); Lizabeth E. Riley, M.D. (Texas at Galveston, 1992); Ivan Savitsky, M.D. (Wayne State, 1994); Jim Shepherd, M.D. (Bowman Gray, 1994); Almaz A. Smith, M.D. (Texas at San Antonio, 1992); Anjali M. Sues, M.D. (North Carolina at Chapel Hill, 1992); Matthew J. Tiefenbrunn, M.D. (Missouri at Columbia, 1993); Denise D. Tollefson, M.D. (Kansas, 1991); Asha Vali, M.D. (India, 1978); Karen L. Weaver, M.D. (Michigan, 1993).

### Medicine

Chief Residents: Kurt O. Bodily, M.D. (Washington, 1990); Dan Ciaccia, M.D. (Wisconsin, 1989).

Senior Assistant Residents: Ghassan J. Al-Zaghrini, M.D. (Beirut, 1992); Alan S. Ament, M.D. (Chicago, 1992); Marissa F. Baldassano, M.D. (Pennsylvania State, 1992); Bshara J. Barakat, M.D. (Beirut, 1992); Marcel D. Bingham, M.D. (North Carolina at Chapel Hill, 1992); Ernest P. Bouras, M.D. (Duke, 1992); S. Maynard Bronstein, M.D. (Duke, 1992); Kenneth M. Burnham, M.D. (Emory, 1992); Patrick J. Cawley, M.D. (Georgetown, 1992); Pamela L. Charity, M.D. (Hahnemann, 1992); Gabriella F. Dennerly, M.D. (Howard, 1992); Sanjay A. Desai, M.D. (Washington Univ., 1992); Robert L. Deucher, M.D. (Duke, 1992); Pang-Chieh "Jerry" Eu, M.D. (Chicago, 1992); David M. Frucht, M.D. (Duke, 1991); Mary J. Geiger, M.D. (Med. Coll. of Wisconsin, 1992); Thomas A. Grady, M.D. (Tufts, 1992); David H. Graff, M.D. (Duke, 1992); Richard K. Groger, M.D. (Case Western Reserve, 1992); Elana Gutman, M.D. (St. Louis, 1992); Eugenio J. Hernandez, M.D. (Duke, 1992); Stephen S. Hwang, M.D. (China Med. Coll., 1987); Fern M. Jeffries, M.D. (Johns Hopkins, 1992); Ali M. Kizilbash, M.D. (Aga Khan Univ., 1990); Paul A. Lawrence, M.D. (South Carolina, 1992); Ruey-Min "Ray" Lee, M.D. (National Taiwan Univ., 1986); Kirsten E. Lyke, M.D. (Georgetown, 1992); Grace J. Makhlof, M.D. (Beirut, 1992); Marcia P. McCampbell, M.D. (Med. Coll. of Georgia, 1992); Kevin M. McGrath, M.D. (Jefferson, 1992); Klaus Mergener, M.D. (Heidelberg, 1989); Julie M. Miller, M.D. (Minnesota, 1992); Sandra Y. Morelock, M.D. (Tennessee, 1992); Lia S. Murphy, M.D. (Johns Hopkins, 1992); H. Derek Palmer, M.D. (Washington, 1992); Robert C. Quacken-



bush, M.D. (Washington Univ., 1992); Adrienne L. Richards, M.D. (Johns Hopkins, 1991); Spencer H. Shao, M.D. (Duke, 1992); Ted S. Steiner, M.D. (Duke, 1992); Mark S. Sulkowski, M.D. (Temple, 1992); John S. Sundry, M.D. (Hahnemann, 1991); Elizabeth A. Talbot, M.D. (Robert Wood Johnson, 1992); Julio Tallet, M.D. (Chicago, 1992); Chen Y. Tung, M.D. (Ohio State, 1992); Chiraj Udomsakdi (Siriraj Sch. of Med., 1988); Stephen J. Wilson, M.D. (Duke, 1992).

Medicine/Pediatrics: Vandana Y. Bhide, M.D. (Wisconsin, 1991); Tamera D. Coyne-Beasley, M.D. (Duke, 1991); Katherine G. Mulligan, M.D. (New Jersey, 1991); Susan M. Wang, M.D. (Columbia, 1991).

Junior Assistant Residents: Barbara D. Alexander, M.D. (East Carolina, 1993); Sana M. Al-Khatib, M.D. (Beirut, 1993); Paul R. Bohjanen, M.D. (Michigan, 1993); William A. Charini, M.D. (California at Irvine, 1993); Richard Chen, M.D. (New York at Stony Brook, 1993); Chih-Hao G. Chou, M.D. (Taipei, 1986); William P. Ciesla, M.D. (Georgetown, 1993); Howard A. Cooper, M.D. (Duke, 1993); Elia J. Duh, M.D. (Harvard, 1993); Mohamad Ali Eloubeidi, M.D. (Beirut, 1993); Vance G. Fowler, M.D. (North Carolina at Chapel Hill, 1993); Cristina Gasperetto, M.D. (Univ. of Rome, 1986); Ajay K. Gopal, M.D. (Emory, 1993); Magnus Gottfredsson, M.D. (Iceland, 1991); Sean W. Hayes, M.D. (California at San Francisco, 1993); Yun-Hui Hsiang, M.D. (Taiwan, 1987); Aamir Javaid, M.D. (Aga Khan, 1991); Thomas J. Lang, M.D. (Maryland, 1993); Thu H. Le, M.D. (George Washington, 1993); Wei-hsung Lin, M.D. (Sun Yat-sen, 1983); Kieren A. Marr, M.D. (Hahnemann, 1993); Robert E. Martell, M.D. (Wayne State, 1993); Ines I. Mbaga, M.D. (Dar es Salaam, 1989); Timothy J. McMahon, M.D. (Tulane, 1993); Jose A. Montero, M.D. (South Florida, 1993); Andrew J. Muir, M.D. (Duke, 1993); Merle Myerson, M.D. (New York at Brooklyn, 1993); Scott M. Palmer, M.D. (Duke, 1993); Matthew T. Roe, M.D. (Duke, 1993); Scott M. Schuetze, M.D. (Oregon, 1993); Heather S. Shaw, M.D. (Duke, 1993); Patricia A. Shi, M.D. (Duke, 1993); Christopher J. Vesey, M.D. (Ohio State, 1993); James D. Whitehouse, M.D. (Emory, 1993); John J. Whyte, M.D. (Hahnemann, 1993); William G. Wierda, M.D. (Chicago Med. Coll., 1993); Michelle P. Winn, M.D. (East Carolina, 1992).

Medicine/Pediatrics: Cory L. Annis, M.D. (Med. Coll. of Georgia, 1992); Tony O. Blue, M.D. (North Carolina at Chapel Hill, 1993); Anthony Buonanno, M.D. (New York at Brooklyn, 1993); David A. Cline, M.D. (Rush, 1993); Herodotos Ellinas, M.D. (Chicago, 1992); Larry W. Kelly, M.D. (Duke, 1993); Jeffrey H. Moreadith, M.D. (Duke, 1992); Christopher D. Pilcher, M.D. (Vermont, 1993); Dannah W. Wray, M.D. (Duke, 1993).

Medicine/Psychiatry: Greg L. Clary, M.D. (Texas at Houston, 1992).

Interns: Amy P. Abernethy, M.D. (Duke, 1994); Kimberly L. Blackwell, M.D. (Mayo, 1994); Richard S. Bloomfield, M.D. (Washington Univ., 1994); Christopher H. Cabell, M.D. (Duke, 1994); Christopher F. Carpenter, M.D. (Michigan, 1994); Margaret A. Carroll, M.D. (George Washington, 1994); Cathleen S. Colon-Emeric, M.D. (Johns Hopkins, 1994); Mark R. Dumais, M.D. (Harvard, 1994); Mark W. Feinberg, M.D. (Med. Coll. of Pennsylvania, 1994); Douglas S. Files, M.D. (Wayne State, 1994); Tejal K. Gandhi, M.D. (Harvard, 1994); John P. Gassler, M.D. (Mount Sinai, 1994); Stacy D. Gittleman, M.D. (Univ. of Maryland, 1993); Kenneth C. Goldberg, M.D. (Med. Coll. of Wisconsin, 1994); Reem M. Haddad, M.D. (New Mexico, 1994); Henry L. Harrell, M.D. (Vanderbilt, 1994); Mitchell T. Hefflin, M.D. (Virginia, 1993); Wenson Hsieh, M.D. (Johns Hopkins, 1994); Muhammad N. Khattak, M.D. (Aga Khan, 1992); Joseph B. Khoury, M.D. (Virginia, 1994); Preston S. Klassen, M.D. (Nebraska, 1994); Li Kuo Kong, M.D. (Washington Univ., 1994); Linda K. Lang, M.D. (Maryland, 1994); Wee-Chin Lin, M.D. (Nat'l Taiwan, 1986); Maria C. Mariencheck, M.D. (Washington Univ., 1994); William I. Mariencheck, M.D. (Washington Univ., 1994); Renee J. Mathur, M.D. (Harvard, 1994); Mitra Maybodi, M.D. (Duke, 1994); Dean S. McGaughey, M.D. (Chicago, 1994); Ramzi Moufarrej, M.D. (Beirut, 1994); Gregory Palega, M.D. (Cornell, 1994); John R. Pawloski, M.D. (St. Louis, 1994); Daniel K. Ries, M.D. (Minnesota, 1994); Paula D. Ryan, M.D. (Rochester, 1994); Michael A. Scherlag, M.D. (Oklahoma, 1994); Andrew M. Schneider, M.D. (Duke, 1994); David E. Schoenfeld, M.D. (Duke, 1994); Jill K. Sisney, M.D. (Oklahoma, 1994); Felicia Skalski, M.D. (UMDNJ, 1994); Steven H. Tai, M.D. (Louisiana State, 1994); Eric J. Velazquez, M.D. (Albert Einstein, 1994); Christopher W. Woods, M.D. (Duke, 1994); Priya B. Yerasi, M.D. (California at San Francisco, 1994).

Medicine/Pediatrics: Weijen Chang, M.D. (NY Med. Coll., 1994); George M. Lyon, M.D. (Marshall, 1994); Tushar N. Shah, M.D. (North Carolina at Chapel Hill, 1994); Suzanne K. Trzcinski, M.D. (Med. Coll. of Ohio, 1994).

Medicine/Neurology: John R. Lynch, M.D. (Duke, 1994); Augusto Parra, M.D. (Escuela Colombiana, 1988).

Medicine/Psychiatry: Kristen A. Tyzkowski, M.D. (Med. Coll. of Ohio, 1994).

Fellows: Igor Z. Abolnik, M.D. (Hadassah Med. Sch., 1988); Murray Abramson, M.D. (Duke, 1991); Wazir N. Ali, M.D. (Robert Wood Johnson, 1992); Peter B. Amsterdam, M.D. (Harvard, 1990); R. David Anderson, M.D. (Hopkins, 1990); Nicholas M. Anstey, M.D. (Royal College of Physicians, 1989); Lennox K. Archibald, M.D. (Univ. Coll. Med. Sch. London, 1984); Brian A. Armstrong, M.D. (Washington Univ., 1988); John M. Arthur, M.D. (Iowa, 1990); Krairerk Athirakul, M.D. (Univ. Prince of Songkla, 1986); William A. Baker, M.D. (Johns Hopkins, 1989); Helen S. Barold, M.D. (Rochester, 1991); Gregory W. Barsness, M.D. (Minnesota, 1991); Bradley A. Bart, M.D. (Minnesota, 1990); Maher A. Baz, M.D. (Beirut, 1989); David A. Beck, M.D. (Iowa, 1989); Alfonso E. Bello, M.D. (Illinois, 1986); Michael A. Blazing, M.D. (California at San Francisco, 1987); Robin E. Boineau, M.D. (Med. Coll. of Georgia, 1990); Jerry J. Boley, M.D. (Johns Hopkins, 1990); Brigitta C. Brott, M.D. (Loyola, 1988); Richard L. Callihan, M.D. (Marshall, 1989); Martha S. Carraway, M.D. (Bowman Gray, 1988); Kelly L. Carson, M.D. (Emory, 1991); Donna L. Cartens, M.D. (McGill, 1990); Russ P. Carstens, M.D. (Yale, 1990); Luis Chu, M.D. (Florida, 1990); Maureen E. Collins,



M.D. (Jefferson, 1991); Gary M. Cox, M.D. (Virginia, 1989); Brian S. Crenshaw, M.D. (Tennessee, 1990); Jennie R. Crews, M.D. (Duke, 1990); Michael S. Cuffe, M.D. (Duke, 1991); Wendy Z. Davis, M.D. (Duke, 1989); David DeNofrio, M.D. (Tufts, 1988); Andrew N. Dentino, M.D. (Mount Sinai, 1989); G. Alfred Dodds, M.D. (Med. Coll. of Ohio, 1988); Rowena J. Dolor, M.D. (Duke, 1991); Jason A. Dominitz, M.D. (Maryland, 1991); Mark H. Drazner, M.D. (Washington Univ., 1989); David E. Edelman, M.D. (Baylor, 1992); Glenn M. Eisen, M.D. (Albert Einstein, 1987); Adahli Estrada-Fernandez, M.D. (Puerto Rico, 1990); Robert E. Federici, M.D. (Georgetown, 1988); David B. Felker, M.D. (Florida, 1991); David C. Fisher, M.D. (Massachusetts, 1989); Nancy R. Foldavary, D. O. (Chicago Coll. of Osteopathic, 1988); Lisa W. Forbess, M.D. (Harvard, 1991); Carlos Garcia, M.D. (Mexico, 1982); Jennifer L. Garst, M.D. (Med. Coll. of Georgia, 1990); Angela Gentili, M.D. (Pavia Univ., 1986); Carl E. Gessner, M.D. (Maryland, 1990); Brian J. Gilmore, M.D. (Pennsylvania, 1988); Niti Goel, M.D. (Jefferson, 1990); Joseph A. Govert, M.D. (California at Irvine, 1989); Taylor R. Graves, M.D. (Johns Hopkins, 1989); Daniela G. Greiner, M.D. (Wolfgang, 1991); Carol L. Gruver, M.D. (Temple, 1984); Christine G. Hahn, M.D. (Michigan State, 1988); James E. Hartle, M.D. (Albert Einstein, 1985); William R. Hathaway, M.D. (Med. Coll. of Wisconsin, 1988); Steven E. Hearne, M.D. (Maryland, 1989); William B. Hillegass, M.D. (Harvard, 1988); Russell E. Hillsley, M.D. (Washington Univ., 1988); James F. Hochrein, M.D. (Ohio, 1990); James F. Hora, M.D. (Loyola, 1990); Allen Hsieh, M.D. (Columbia, 1991); Olafur S. Indridason, M.D. (Iceland, 1987); Nicole Jelesoff, M.D. (Georgetown, 1991); Stephen Kantrow, M.D. (Louisiana, 1988); Theresa E. Kehoe, M.D. (Maryland, 1991); Sheri A. Keitz, M.D. (Mount Sinai, 1991); Christopher D. Kontos, M.D. (Med. Coll. of Virginia, 1989); Jeffrey M. Kopita, M.D. (Med. Coll. of Ohio, 1989); Kevin R. Kruse, M.D. (Ohio, 1989); Mima Ktali, M.D. (Beirut, 1991); Jody Kujovich, M.D. (Harvard, 1989); Daniel T. Layish, M.D. (Boston, 1990); Scott L. Letendre, M.D. (Georgetown, 1986); Marc C. Levesque, M.D. (Yale, 1989); Scott G. Lilly, M.D. (Med. Coll. of Ohio, 1991); Susan J. Littman, M.D. (Albany, 1989); Kevin Lorentsen, M.D. (Johns Hopkins, 1989); Louis M. Luttrell, M.D. (Virginia, 1989); Kenneth W. Mahaffey, M.D. (Washington, 1989); Antony G. Maniatis, M.D. (California at San Francisco, 1989); P. Kelly Marcom, M.D. (Baylor, 1989); Frank J. Martell, M.D. (South Florida, 1990); Kimberly A. Mebust, M.D. (Connecticut, 1990); Frances T. Meredith, M.D. (Virginia, 1991); Matthew N. Meriggioli, M.D. (Chicago, 1986); David W. Miller, M.D. (Med. Coll. of Georgia, 1990); Stephan Moll, M.D. (Freiburg, 1986); Edward I. Morris, M.D. (Howard, 1991); Michael A. Morse, M.D. (Yale, 1990); Lisa E. Mount, M.D. (Med. Coll. of South Carolina, 1990); Raja Mudad, M.D. (Beirut, 1989); Jeffrey B. Mundorf, M.D. (Southwestern 1990); Lawrence A. Nair, M.D. (Pennsylvania, 1988); Muhammad A. Nayer, M.D. (Dow Medical, 1987); Keith H. Newby, M.D. (Eastern Virginia, 1990); Michael K. Newcomer, M.D. (Case Western Reserve, 1988); Carleton T. Nibley, M.D. (California at Los Angeles, 1988); James C. Oates, M.D. (Johns Hopkins, 1991); Augustine U. Obi, M.D. (Lagos, 1980); Michael I. Oliverio, M.D. (West Virginia, 1990); Sohail Parekh, M.D. (Dow Medical, 1986); Jorge Pascual, M.D. (Rio de Janeiro, 1981); Suzanne Patton, M.D. (Duke, 1988); Paul A. Payne, M.D. (Duke, 1987); Laura A. Peno-Green, M.D. (South Alabama, 1990); Derek A. Persons, M.D. (Duke, 1991); Eric D. Peterson, M.D. (Pittsburgh, 1988); Glen L. Portwood, M.D. (Med. Coll. of Georgia, 1989); Robert J. Pritchard, M.D. (Wayne State, 1989); Mark W. Pulsipher, M.D. (Utah, 1988); Loretta G. 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## Ophthalmology

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Residents: Dipoli Apteé, M.D. Illinois, 1993), Ph.D. (Illinois, 1992); Charles Bach, M.D. (Northwest-ern, 1993); Yun-sen Ralph Chu, M.D. (Northwestern, 1992); Laura Enyedi, M.D. (North Carolina, 1993); Sundeep Dev, M.D. (Boston Univ., 1993); Maria Gottfreosdottir, M.D. (Univ. of Iceland, 1989); Jeehee Kim, M.D. (Chicago-Pritzker, 1992); Nauman Imani, M.D. (Florida, 1992); Joseph Khawly, M.D. (Duke, 1991); Pauline Merrill, M.D. (Washington Univ., 1991); Robert A. Mittra, M.D. (Pennsylvania, 1992); Scott Pendergast, M.D. (Boston, 1991); Karen Popovich, M.D. (North Carolina at Chapel Hill, 1990); Eric Postel, M.D. (Jefferson, 1991).

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Fellows: Nicholas Banderenko, M.D. (Duke, 1990); Laura Hale, M.D. (Duke, 1991), Ph.D. (Duke, 1990); Clifford L. McDonald, M.D. (Northwestern, 1987); Thomas Montine, M.D. (McGill Univ., 1991), Ph.D. (Rochester, 1988); John Toso, M.D. (Pittsburgh, 1992); Anita K. M. Zaidi, M.D. (Aga Khan, 1980).

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Second Year Residents: Natalie Beltran, M.D. (Virginia, 1993); Rochelle Benson, M.D. (Texas, Galveston, 1993); Susan Boutilier, M.D. (California, Davis, 1993); Jennifer Cohen, M.D. (Tufts, 1993); Amy Forsythe-Mor-gan, M.D. (Thomas Jefferson, 1993); Patrick Frias, M.D. (Nebraska, 1993) Melissa Garretson, M.D. (Mayo,



1993); Christopher Hubble, M.D. (South Florida, 1993); Alex Kemper, M.D. (Duke, 1993); Richard Klaas, M.D. (Michigan, 1993); Douglas Kwock, M.D. (Hawaii, 1993); Jennifer Tiller, M.D. (Texas, Galveston, 1993).

**First Year Residents:** Marc Bahan, M.D. (Med. Univ. South Carolina, 1994); Kelly Bennie, M.D. (Tennessee, 1994); Laura Brooks, M.D. (Virginia, 1994); Michael Deitchman, M.D. (Texas, Galveston, 1994); Kathleen Gallagher, M.D. (Bowman Gray, 1994); Michelle Halby, M.D. (East Carolina, 1994); Nadia Ibrahim, M.D. (Georgetown, 1994); Alica Johnston, M.D. (SUNY, Syracuse, 1994); Henry Lew, M.D. (National Taiwan Univ., 1994); William McCann, M.D. (Georgetown, 1994); Michele McCormick, M.D. (Med. Univ. South Carolina, 1994); Steven Mumbauer, M.D. (Temple, 1994); Rebecca Passon, M.D. (Pennsylvania State, 1994); Jeffrey Ryan, M.D. (Med. Col. Ohio, 1994); Henry Sakai, M.D. (Virginia, 1994).

**Fellows:** Denise Adams, M.D. (Georgetown, 1988); Adegboyega Aderibigbe, M.D. (Ife University, Nigeria, 1983); Kenneth Alexander, M.D. (Washington, 1989); Nejemie Alter, M.D. (Univ. Nacionel Autonoma de Mexico, 1985); David Ashley, M.B., B.S., Ph.D. (Monash Univ., Melbourne, Australia, 1986); Jacqueline Barclay, M.D. (Pittsburgh, 1992); Robert Bart, M.D. (John Burns, 1990); Elizabeth Bello, M.D. (Illinois, 1990); Donald Black, M.D. (New York, Syracuse, 1989); Jacob Bleasing, M.D. (Leiden, The Netherlands, 1989); Krystal Sanchez Bottom, M.D. (Florida, 1989); Charlene Broome, M.D. (Mississippi, 1989); Miguela Caniza, M.D. (Univ. Nacional de Asuncion, Paraguay, 1982); Michael Carboni, M.D. (Northeastern, 1990); Ira Cheifetz, M.D. (Yale, 1989); Adam Cutler, M.D. (Tel Aviv, 1989); Timothy Driscoll, M.D. (Ohio State, 1990); Bruce Finkel, M.D. (South Carolina, 1990); Craig Fleishman, M.D. (Yale, 1989); Eva Nozik Grayck, M.D. (Colorado, 1988); Brandt Groh, M.D. (Wisconsin, 1987); Gregory Hanissian, M.B. Ch.B. (Alabama, 1991); Nasser Helali, M.D. (King Abdulaziz Univ., Saudia Arabia, 1984); Charles Hemenway, M.D. (Massachusetts, 1987); Rene Herlong, M.D. (Duke, 1989); Cynthia Jackson, D.O. (Univ. of Osteopath, Iowa, 1989); Esam Kazem, M.D. (Al-Azhar, Egypt, 1981); Priya Kishnani, M.B., B.S. (Bombay, 1985); Jennifer Knight, M.B., B.S. (West Indies, 1988); Cecilia Kuyper, M.D. (Washington, 1990); Mary Lacaze, M.D. (Autonomous Univ. of Guadalajara, 1989); J. Blake Long, M.D. (Duke, 1986); Arif Mannan, M.B. (Dow Med. Coll., Pakistan, 1989); Geoffrey McCowage, M.B., B.S. (Sydney, Australia, 1985); John McGovern, M.D. (Ohio State, 1990); Robert Nahouraii, M.D. (Pittsburgh, 1989); Pamela Palasanthiran, M.B., B.S. (Univ. of Melbourne, Australia, 1983); Andrew Pendleton, M.D. (South Carolina, 1989); Jerald Purifoy, M.D. (Michigan, 1987); James Rost, M.D. (Brown, 1991); Ziad Saba, M.D. (American Univ. of Beirut, 1987); James Short, M.D. (Texas at Houston, 1989); Mimi Tang, M.D. (Univ. of Melbourne, Australia, 1986); Charles Trant, M.D. (East Carolina, 1989); Johan Van Hove, M.D. (Katholieke Univ., Belgium, 1986); Curt Watkins, M.D. (Tufts, 1991); Stuart Winter, M.D. (Wiscnsin, 1988); James Woodward, M.D. (St. Louis, 1989); Sherri Zimmerman, M.D. (North Carolina, 1991).

**Medicine/Pediatrics Fourth Year Residents:** Vandana Bhide, M.D. (Wisconsin, 1991); Tamara Coyne-Beasley, M.D. (Duke, 1991); Katherine Mulligan, M.D. (New Jersey, 1991); Susan Wang, M.D., M.P.H. (Columbia, 1991).

**Third Year Residents:** Cory Annis, M.D. (Med. Coll. Georgia, 1992); Herodotos Ellinas, M.D. (Chicago, 1992); Jeffrey Moreadith, M.D. (Duke, 1992).

**Second Year Residents:** Tony Blue, M.D. (North Carolina at Chapel Hill, 1993); Anthony Buonanno, M.D. (SUNY, Brooklyn, 1993); David Cline, M.D. (Rush, 1993); Larry Kelly, M.D. (Duke, 1993); Christopher Pilcher, M.D. (Vermont, 1993); Dannah Wray, M.D. (Duke, 1993).

**First Year Residents:** Weijen Chang, M.D. (New York Med. Coll., 1994); G. Marshall Lyon, Jr., M.D. (Marshall, 1994); Tushar Shah, M.D. (North Carolina, 1994); Suzanne Trzcinski, M.D. (Med. Coll. Ohio, 1994).

## Psychiatry

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**Fourth Year Residents:** Tedra Anderson-Brown, M.D. (Duke, 1991); Sarah Book, M.D. (Duke, 1991); Bruce Capehart, M.D. (Texas at Southwestern, 1991); Murali Doraiswamy, M.D. (Univ. of Madras, India, 1986); Fay Ferrell, M.D. (Chicago, 1991); Holly Lisanby, M.D. (Duke, 1991); Rob Millet, M.D. (Louisiana, 1991); Nick Potts, M.D. (Flinders Univ., Australia, 1988); Chuck Swanson, M.D. (Indiana, 1991); Susan VanMeter, M.D. (Oklahoma, 1991); Rob White, M.D. (Kentucky, 1991).

**Third Year Residents:** Barbara Burtner, M.D. (Med. Coll. of Virginia, 1992); Terry Clapacs, M.D. (Duke, 1992); Greg Clary, M.D. (Texas at Houston, 1992); Helen Egger, M.D. (Yale, 1991); Molly Froelich, M.D. (North Carolina, 1988); Haleh Ghanizadeh, M.D. (Rochester, 1992); Tracey Holsinger, M.D. (Virginia, 1992); Doris Iarovici, M.D. (Yale, 1992); Gurpreet Jawa, M.D. (North Carolina at Chapel Hill, 1992); Arif Kamran, M.D. (Allama Iqbal-Pakistan, 1987); Myra McSwain, M.D. (Med. Coll. of Georgia, 1992); Elizabeth Murry, M.D. (Arkansas, 1992); Bill Price, M.D. (North Carolina at Chapel Hill, 1985); Krishna Talluri, M.D. (SV Med Coll., India, 1974); Mark Vakkur, M.D. (Duke, 1992); Kendall Warden, M.D. (Missouri, 1991); Vince Watts, M.D. (Oklahoma, 1992).

**Second Year Residents:** Ayesha Chaudhary, M.D. (Aga Khan Univ. Med. Coll., 1991); Venkata Chittilla, M.D. (Andhra Medical College, 1987); Kathryn Connor, M.D. (Maryland, 1993); Pawel Dudek, M.D. (Copernicus Med. Sch., Poland, 1988); Ken Gersing, M.D. (Washington, 1993); Paul Grant, M.D. (Bowman Gray, 1973); Justine Greathouse, M.D. (Med. Coll. of Ohio, 1993); John Heintzman, M.D. (Queens Univ., Canada, 1993); Mike Hughes, M.D. (Bowman Gray, 1993); Danuta Jagla-Schudel, M.D.



(Mikolaj Kopernik Acad, 1988); Bruce Riggins, M.D. (Med. Coll. of Georgia, 1992); Robert Schneider, M.D. (Emory, 1985); Charles Vance, M.D. (Duke, 1993); Jill Williams, M.D. (UMDNJ-Robert Johnson, 1993).

First Year Residents: Nives Antolovic-Stanfel, M.D. (Zagreb Med. Faculty, 1983); Maureen Behr, M.D. (New York at Syracuse, 1994); Charles Beltz, M.D. (North Carolina at Chapel Hill, 1994); Suvrat Bhargava, M.D. (Med. Coll. of Georgia, 1994); Sharon Curtis, M.D. (Missouri, 1994); Hector DeLeon-Miranda, M.D. (Univ. Central De Caribe, 1994); Ali El-Menshaw, M.D. Ph.D. (Alexandria Univ., Egypt, 1976); Luiz Gazzola, M.D. Ph.D. (Univ. of Minas Gerhs, Brazil, 1980); Beverly Grimm, M.D. (Miami, 1994); Elizabeth Hogan-Bates, M.D. (Texas at Southwestern, 1994); Amy Jones, M.D. (South Carolina, 1994); Erik Lindfors, M.D. (Texas, 1994); Christine Marx, M.D. (Duke, 1993); Ramin Parsey, M.D. (Maryland, 1993); Kristen Tsyzkowski, M.D. (Temple, 1994).

Fellows: Peter Borboriak, M.D. (Duke, 1989); Richard D'Alli, M.D. (Arizona, 1991); Craig Donnelly, M.D. (Vermont, 1989); Steven Heinmann, M.D. (Eastern Virginia, 1990); Debora LaMonica, M.D. (Massachusetts, 1989); Rodolfo Ongioco, M.D. (Downstate Med. Centre, 1988); Dawn Picotte-Prillmayer, M.D. (South Florida, 1991); Karen Pigott, M.D. (Ohio, 1990); Charles Pryzant, M.D. (Baylor, 1990); Davendra Shah, M.D. (BJ Med. Coll., India, 1979).

## Radiation Oncology

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## Radiology

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## SURGERY

### DIVISIONS OF GENERAL AND CARDIOTHORACIC SURGERY

Instructors and Teaching Scholars: Joseph R. Elbeery, M.D. (Georgetown, 1985); J. Scott Kabas, M.D. (Duke, 1985); Kevin P. Landolfo, M.D. (Univ. of Manitoba, 1985); John C. Lucke, M.D. (St. Louis, 1985).

Instructors and Chief Residents: Thomas A. D'Amico, M.D. (Columbia, 1987); Andrew M. Davidoff, M.D. (Pennsylvania, 1987); Stanley A. Gall, M.D. (Duke, 1987); Jeffrey S. Heinle, M.D. (Pittsburgh, 1987); Scott H. Johnson, M.D. (Duke, 1986); Lewis B. Schwartz, M.D. (Chicago, 1987); Mark W. Sebastian, M.D. (Rush, 1987).

Cardiothoracic Fellows: Theodore C. Koutlas, M.D. (Washington, 1987); Mark D. Plunkett, M.D. (North Carolina at Chapel Hill, 1986).

Research Fellows: Cristobal G. Alvarado, M.D. (New York, 1991); Hartmuth B. Bittner, M.D. (Univ. of Heidelberg, 1989); Matilde Butos, M.D. (Univ. of Granada, Spain, 1986); Ravi S. Chari, M.D. (University of Saskatchewan, Canada, 1989); Bryan M. Clary, M.D. (California at San Francisco, 1991); Bradley H. Collins, M.D. (Duke, 1989); Adrian H. Cotterell, M.D. (Duke, 1991); Eamonn C. Coveney, M.B., B.Ch. (University College, Dublin, 1987); Mark G. Davies, M.B., B.Ch. (Univ. of Dublin, 1986); Louis R. DiBernardo, M.D. (Duke, 1991); J. Michael DiMaio, M.D. (Miami, 1987); Francis G. Duhaylongsod, M.D. (Meharry Med. Coll., 1986); Steve Eubanks, M.D. (Alabama, 1987); Joseph M. Forbess, M.D. (Harvard, 1990); Ivo Hanke, M.D. (Masaryk Univ., Czech., 1988); Neal D. Hillman, M.D. (Colorado, 1987); Chung-Ping Hsu, M.D. (National Defense Medical Center, Taiwan, 1980); Simon W. H. Kendall, M.B.B.S. (Middlesex Hospital Medical School, 1984); Paul M. Kirshbom, M.D. (Johns Hopkins, 1991); William A. Larchian, M.D. (Boston Univ., 1984); John C. Magee, M.D. (Jefferson, 1988); Christopher R. Mantyh, M.D. (Wisconsin, 1991); Kenneth R. McCurry, M.D. (Florida, 1987); Carmelo A. Milano, M.D. (Chicago, 1990); Toshikata Okumura, M.D. (Asahikawa Med. Coll., Japan, 1984); R. Antonio Perez-Tamayo, M.D.

(Chicago, 1990); Scott K. Pruitt, M.D. (Columbia, 1987); Scott C. Silvestry, M.D. (Pennsylvania, 1991); Lynne A. Skaryak, M.D. (Duke, 1989); Johannes Vieweg, M.D. (Tech. Univ. of Munich Med. Sch., Germany, 1988).

Senior Assistant Residents: Paul M. Ahearne, M.D. (Duke, 1988); Mary T. Amato, M.D. (Duke, 1991); Mark P. Anstadt, M.D. (Wright State, 1986); Christine A. Cheng, M.D. (Duke, 1991); Allan D. Kirk, M.D. (Duke, 1987); James R. Mault, M.D. (Michigan, 1988); Cary H. Meyers, M.D. (Chicago, 1988); Clarence H. Owen, M.D. (Duke, 1989); Jeffrey C. Pence, M.D. (New York Med. Coll., 1986); David S. Peterseim, M.D. (Washington Univ., 1988); William N. Peugh, M.D. (Washington Univ., 1990); Cemil M. Purut, M.D. (Duke, 1987); Mark Tedder, M.D. (Duke, 1988); Christina Weltz, M.D. (Pennsylvania, 1989).

Junior Assistant Residents: Victor E. Abraham, M.D. (Temple, 1988); Michael L. Beckish, M.D. (Minnesota, 1992); Michael E. Berend, M.D. (Duke, 1992); Christian P. Christensen, M.D. (Vanderbilt, 1992); Eric L. Cole, M.D. (Duke, 1992); Brian M. Crites, M.D. (Indiana, 1992); Larkin J. Daniels, M.D. (Alabama, 1992); James J. Davidson, M.D. (Duke, 1992); R. William Farmer, M.D. (Duke, 1989); Charles W. Hoopes, M.D. (Duke, 1992); Jeffrey J. Lawson, M.D. (Vermont, 1992); R. Eric Lilly, M.D. (Duke, 1992); Shu S. Lin, M.D. (Duke, 1992); Brian C. Murphy, M.D. (Duke, 1992); Jeffrey A. Murray, M.D. (Virginia, 1992); Thomas J. Noonan, M.D. (Duke, 1992); Brian P. Perry, M.D. (Nebraska, 1992); James D. St. Louis, M.D. (Georgetown, 1992); Jeffrey E. Taber, M.D. (Duke, 1992); Bryan C. Weidner, M.D. (Pennsylvania, 1992); Clifford R. Wheelles, M.D. (North Carolina at Chapel Hill, 1992).

First Year Residents: Shahab A. Akhter, M.D. (Chicago-Pritzker, 1993); Shawn C. Bonsell, M.D. (Oregon Health Sciences, 1993); Philip E. Clifford, M.D. (Florida, 1993); Robert E. Coles, M.D. (Duke, 1993); G. Scott Dean, M.D. (Duke, 1993); Roberto F. Ferraro, M.D. (Rush, 1993); Kevin B. Fitzgerald, M.D. (Baylor, 1993); Roy E. Gaines, Jr., M.D. (Cincinnati, 1993); Stanley C. Hall, M.D. (Med. Coll. of Virginia, 1993); Joshua B. Helman, M.D. (Harvard, 1993); Spero G. Karas, M.D. (Indiana, 1993); Joseph L. Koen, M.D. (Ohio State, 1993); Alan P. Kypson, M.D. (Columbia, 1993); Cleveland W. Lewis, Jr., M.D. (Duke, 1993); Anson S. Li, M.D. (Duke, 1993); Edward G. Lilly III, M.D. (Duke, 1993); Andrew J. Lodge, M.D. (Duke, 1993); Kendra P. Magee, M.D. (Washington, 1993); Marga F. Massey, M.D. (Duke, 1993); Sumeet Mathur, M.D. (Harvard, 1993); Robert B. Noone, M.D. (Pennsylvania, 1993); James A. O'Leary, M.D. (Vanderbilt, 1993); Samuel D. Stanley, M.D. (Duke, 1993); Patrick J. Walsh, M.D. (East Carolina, 1993); Justin S. Wu, M.D. (Harvard, 1993).

## **DIVISION OF NEUROSURGERY**

Instructors and Chief Residents: Sarah J. Gaskill, M.D. (Texas Health 778 Sciences Center, 1988); Monica W. Loke, M.D. (Chicago, 1988); Christopher G. Paramore, M.D. (Duke, 1987).

Assistant Residents: Richard M. Foltz, M.D. (Texas Tech., 1988); Eric M. Gabriel, M.D. (Robert Wood Johnson, 1992); Philip Henkin, M.D. (Ohio State, 1991); Bermans J. Iskandar, M.D. (Pennsylvania, 1989); James R. Nashold, M.D. (East Carolina, 1990); John H. Sampson, M.D. (Canadian Medical School, 1990); John C. Stevenson, M.D., Ch.B. (University of Glasgow, Scotland, 1988); Kasia Van Pett, M.D. (Stanford, 1991).

## **DIVISION OF ORTHOPAEDIC SURGERY**

Instructors and Chief Residents: Deanna M. Boyette, M.D. (East Carolina, 1988); Philip G. Coogan, M.D. (Vanderbilt, 1988); Robert L. Friedman, M.D. (California at Los Angeles, 1988); Scott R. Jacobson, M.D. (California at Los Angeles, 1988); Robert L. Kimber, M.D. (Emory, 1988); David D. Lahr, M.D. (Hahnemann, 1988); Robert E. Lins, M.D. (Michigan, 1988); Patrick J. Padilla, M.D. (California at Los Angeles, 1988).

Assistant Residents: Jeff D. Almand, M.D. (Tulane, 1991); Frank V. Aluisio, M.D. (Emory, 1991); David L. Cannon, M.D. (Cornell, 1991); James D. Dalton, Jr., M.D. (Duke, 1990); David T. Dellaero, M.D. (Baylor, 1990); Gregory A. Demopoulos, M.D. (Stanford, 1988); Sanjay S. Desai, M.D. (George Washington, 1984); John A. Fox, M.D. (Columbia, 1989); James E. Gilbert, M.D. (Georgetown, 1990); Charles L. Herring, Jr., M.D. (Oklahoma, 1986); Eric D. Hoffman, M.D. (Duke, 1991); James C. Karegeannes, M.D. (Duke, 1989); Keith Kenter, M.D. (Missouri, 1990); Robert C. Kime III, M.D. (Duke, 1989); Charles M. LeCroy, M.D. (Duke, 1989); Cobi Lidor, M.D. (Technion, Israel, 1979); Philip W. Mack, M.D. (California at Irvine, 1989); Scott D. Mair, M.D. (Duke, 1991); John B. Mason, M.D. (South Carolina, 1989); Robert D. Mastey, M.D. (Robert Wood Johnson, 1989); T. Paul McDermott, Jr., M.D. (Duke, 1991); Bruce J. Montella, M.D. (Chicago, 1990); Gregory S. Motley, M.D. (Kentucky, 1991); John H. Murray, M.D. (Virginia, 1990); Michael L. Parks, M.D. (South Carolina, 1990); Robert A. Pedowitz, M.D. (California at San Diego, 1985); Joseph R. Perno, M.D. (Duke, 1990); Scot E. Reeg, M.D. (Illinois, 1989); David S. Ruch, M.D. (Bowman Gray, 1988); Peter I. Sallay, M.D. (Indiana, 1988); David A. Spiegel, M.D. (Duke, 1990); Robert J. Spinner, M.D. (Mayo, 1990); Cooper L. Terry, M.D. (Vanderbilt, 1989).

## **DIVISION OF OTOLARYNGOLOGY**

Instructors and Chief Residents: Mark L. Hagood, M.D. (Alabama, 1989); F.P. Johns Langford, M.D. (Mississippi, 1989); David W. Molter, M.D. (Duke, 1988).

Assistant Residents: Kevin M. Doyle, M.D. (Duke, 1991); Mark K. Lavigne, M.D. (East Carolina, 1990); Ben H. Lee, M.D. (Colorado, 1990); Stephen B. Potts, M.D. (Duke, 1991); Arvinder S. Uppal, M.D. (Jefferson, 1990); James T. Wright, M.D. (Texas, 1990).



## **DIVISION OF PLASTIC AND MAXILLOFACIAL SURGERY**

Instructors and Chief Residents: Peter A. Aldea, M.D. (Columbia, 1983); Nikolai Nikolov, M.D. (Louisville, 1986); Rainer Sachse, M.D. (Fredrick Alexander Univ, West Germany, 1983).

Assistant Residents: Tad R. Heinz, M.D. (Duke, 1987); Christopher J. Morea, M.D. (Georgetown, 1988); Robert D. Rehnke, M.D. (Duke, 1986); Michael J. Sundine, M.D. (St. Louis, 1987); Eric R. Van Buskirk, M.D. (Virginia, 1985); George P. Zavitsanos, M.D. (Temple, 1988).

## **DIVISION OF UROLOGY**

Instructors and Chief Residents: Jeffrey R. Gingrich, M.D. (Michigan, 1987); William W. Kerfoot, M.D. (South Florida, 1985); Luis M. Perez, M.D. (Albert Einstein, 1988); Albert Ruenes, M.D. (Columbia, 1988).

Assistant Residents: Micaela Aleman, M.D. (Baylor, 1990); Christopher L. Amling, M.D. (Oregon, 1985); Nathaniel Barnes, M.D. (Harvard, 1989); Roland M. Friedman, M.D. (Med. Coll. of Virginia, 1988); George K. Ibrahim, M.D. (Duke, 1988); Jay H. Kim, M.D. (Boston, 1989); Kelly E. Maloney, M.D. (Dalhousie Univ., 1990); Joseph Neighbors, M.D. (Med. Coll. of Virginia, 1990); Neal J. Prendergast, M.D. (Case Western Reserve, 1991); David T. Price, M.D. (Louisiana, 1989); John S. Wiener, M.D. (Tulane, 1988).

Research Fellow: Han Yong Choi, M.D. (Med. Coll. of Seoul National Univ, Korea, 1977).





## CLASS ROSTER\*

### Class of 1995

Aldous, Mark D. (North Carolina State), Burlington, North Carolina  
Aldridge, Howard K. (Emory), Covington, Georgia  
Allen, Diane M. (Vanderbilt), Lexington, Kentucky  
Allen, Quentin B. (Morehouse), Tampa, Florida  
Argenta, Peter A. (Michigan-Ann Arbor), Winston-Salem, North Carolina  
Atkins, Broadus Z. (North Carolina at Charlotte), Mt. Airy, North Carolina  
Avva, Ravisankar R. (North Carolina at Chapel Hill), Durham, North Carolina  
Bachman, Eric S. (Cornell), Tonawanda, New York  
Baker, Carol I. (Virginia), Charlotte, North Carolina  
Ballard, Timothy C. (Harvard), Scarsdale, New York  
Barbee Daniel G. (William and Mary), Lumberton, North Carolina  
Barry, Todd Skipper (North Carolina at Chapel Hill), Chapel Hill, North Carolina  
Belmont, Philip J., Jr. (United States Military Academy), Cincinnati, Ohio  
Berkowitz, Beth Jo (Cornell), Coral Gables, Florida  
Blobe, Gerard C. (Notre Dame), Coopersburg, Pennsylvania  
Boulware, Leigh E. (Vassar), Cleveland Heights, Ohio  
Bowen, Patrick H. (Yale), Potomac, Maryland  
Bruno, Dieter (Duke), Durham, North Carolina  
Chang, Christine (Duke), Torrance, Pennsylvania  
Chen, Daryl M. (Johns Hopkins), Kings Mountain, North Carolina  
Clarke, Scott R. (North Carolina at Chapel Hill), Chapel Hill, North Carolina  
Cothran, Roger L., Jr. (Duke), Huntersville, North Carolina  
Coviello, Andrea D. (Duke), Durham, North Carolina  
Dabal, Robert J. (North Carolina at Chapel Hill), Trinity, North Carolina  
Dar, Mohammed M. (North Carolina at Chapel Hill), Greenville, North Carolina  
Drachman, Douglas E. (Harvard), Concord, Massachusetts  
Drapkin, Anne L. (Dartmouth), Palo Alto, California  
Dunk, Andrea Monroe (Duke), Durham, North Carolina  
Elkousy, Hussein A. (Duke), Chillicothe, Ohio  
Feingold, Steven A. (Yale), Scarsdale, New York  
Forman, Mark S. (Yale), Great Neck, New York  
Fromer, Eric S. (Virginia), McLean, Virginia  
Frucht, Michael M. (Virginia), Fort Washington, Maryland  
Gerke, Calvin G., Jr. (Texas at Austin), Durham, North Carolina  
Gimbel, Michael L. (Cornell), Atlanta, Georgia  
Goodell, Maryellen R. (Cornell), Buffalo, New York  
Gorman, C. Nicole (Pennsylvania), Greensboro, North Carolina  
Gorske, Andrew C. (United States Military Academy), Fond du Lac, Wisconsin  
Gottzman, Michael B. (Duke), Glen Ellyn, Illinois  
Grewal, Ajita (Davidson), New Bern, North Carolina  
Grigg, Diane M. (Duke), Rock Hill, South Carolina  
Grisson, Allen T. (Johns Hopkins), Florence, Alabama  
Hakanson, Robyn J. (Davidson), Durham, North Carolina  
Hall, William L. (California at San Diego), Hillsborough, North Carolina  
Havrilesky, Laura J. (Williams), Durham, North Carolina  
Hayden, Michael N. (Iowa), Muscatine, Louisiana  
Henn, Jeffrey S. (Ohio State), Kirtland, Ohio  
Hughes, George C., IV (Wake Forest), Durham, North Carolina  
Idriss, Salim F. (Duke), Sturgis, Michigan  
Ingledue, Vickie Fowler (North Carolina at Chapel Hill), Crumpler, North Carolina  
Jacobs, James R. (Johns Hopkins), Durham, North Carolina  
Johns, Jeffery S. (North Carolina at Chapel Hill), Charlotte, North Carolina  
Kandzari, David E. (Duke), Morgantown, West Virginia  
Kent, Steven M. (Duke), Thomaston, Maine  
Kim, Patrick K. (Brown), Beckley, West Virginia  
Klenz, Mary E. (North Carolina at Chapel Hill), Charlotte, North Carolina  
Knaut, Andrew L. (Duke), Durham, North Carolina  
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\*Self-reported permanent address.

Lane, Steven C. (North Carolina at Chapel Hill), Durham, North Carolina  
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 Lenczowski, Joi M. (Tulane), Fairfax, Virginia  
 Leonardo, Marc E. (Pennsylvania), Gladwyne, Pennsylvania  
 Lin, Steven H. (Duke), Cary, North Carolina  
 Linardic, Corinne (Duke), Durham, North Carolina  
 Louis, Nancy A. (Dartmouth), Brandon, Vermont  
 Lowry, Lisa P. (Notre Dame), Southern Pines, North Carolina  
 Lunin, Scott D. (Washington), El Toro, California  
 Lynch, Kathryn J. (Catholic University of America), Durham, North Carolina  
 Martin, Shona Ferrier (North Carolina at Chapel Hill), Charlotte, North Carolina  
 McMann, Amy E. (Duke), Chevy Chase, Maryland  
 Mefford, Ivan N. (Kentucky State), Germantown, Maryland  
 Moore, Nathaniel J. (Stanford), Elizabethtown, North Carolina  
 Moran, Susan E. (Virginia), Redwood City, California  
 Morris, Alison M. (Harvard), North Dartmouth, Massachusetts  
 Moynihan, Mark K. (Dartmouth), Worcester, Massachusetts  
 Nichols, William G. (Virginia), Coral Gables, Florida  
 Norton, Carol B. (Wellesley), Dallas, Texas  
 Owens, Harold P., Jr. (Morehouse), Kansas City, Kansas  
 Paolini, John F. (Tulane), New Orleans, Louisiana  
 Passe, Theodore J. (Notre Dame), Wabasha, Minnesota  
 Penczak, Gennifer Geller (Haverford), Manhasset, New York  
 Perkins, Stephen L. (North Carolina State), Lillington, North Carolina  
 Posaw, Leila L. (Wellesley), Syracuse, New York  
 Potts, Kevin E. (Missouri-Columbia), St. Louis, Missouri  
 Pryor, Aurora D. (Duke), Durham, North Carolina  
 Rajagopalan, Pradeep (Duke), Durham, North Carolina  
 Rao, Geetha S. (Johns Hopkins), Murphy, North Carolina  
 Recchia, Franco M. (Wayne State), East Detroit, Michigan  
 Rifkin, Gabrielle B. (Wisconsin), Palatine, Illinois  
 Romp, Katherine G. (Mount Holyoke), Saluda, North Carolina  
 Romp, Robb L. (Yale), Greensboro, North Carolina  
 Ruiz, Robert E. (Akron-Main Campus), Durham, North Carolina  
 Samy, Ravi N. (Duke), Wichita Falls, Texas  
 Savarese, John J. (Holy Cross), Weston, Connecticut  
 Schatte, Edward C. (North Carolina State), Garner, North Carolina  
 Schneider, Amy Opperman (Duke), Solon, Ohio  
 Shah, Ketan D. (Emory), Charlotte, North Carolina  
 Shawen, Scott B. (Brigham Young), Spokane, Washington  
 Shiller, Andrew D. (Massachusetts Institute of Technology), Westport, Connecticut  
 Skarada, Douglas J. (Cornell), Warren, Pennsylvania  
 Smith, Peter J. (Notre Dame), Wilmette, Illinois  
 Smothers, Chandra D. (Princeton), Memphis, Tennessee  
 Sperling, Robert T. (Stanford), San Rafael, California  
 Steer, Dylan L. (Oberlin), Newton, Massachusetts  
 Sue, Sean R. (Virginia), St. Albans, New York  
 Thompson, Annemarie (Duke), Durham, North Carolina  
 Tseng, Jennifer E. (Johns Hopkins), Shreveport, Louisiana  
 Usadi, Moshe Mark E. (Yale), Durham, North Carolina  
 Usadi, Rebecca S. (Rutgers), Durham, North Carolina  
 Watson, Mark (Rice), Durham, North Carolina  
 Weissler, Marla (Duke), Key Biscayne, Florida  
 Wellington, Melanie A. (Brown), Landenberg, Pennsylvania  
 Wenzel, Christopher T. (Davidson), Clyde, North Carolina  
 Wilborn, Anita M. (Vanderbilt), Clarksville, Tennessee  
 Woo, Emily J. (Swarthmore), Raleigh, North Carolina

## Class of 1996

Advani, Anjali S. (Princeton), Durham, North Carolina  
 Anthony, Evelyn Y. (North Carolina at Chapel Hill), Durham, North Carolina  
 Arles, Stephen P. (Lafayette), Durham, North Carolina  
 Armstrong, Christine B. (Virginia), Durham, North Carolina  
 Axelrod, David A. (Harvard), Durham, North Carolina  
 Baird, Paul T., Jr. (Duke), Vienna, Virginia  
 Bernstein, Crystal L. (North Carolina at Chapel Hill), Durham, North Carolina  
 Binder, Devin K. (Harvard), Berkeley, California

Biswas, Shankha S. (North Carolina at Chapel Hill), Chapel Hill, North Carolina  
 Bowman, Brian P. (Tampa), Durham, North Carolina  
 Boyd, Cynthia M. (Yale), Rumson, New Jersey  
 Brenner, Louis (Yale), Peabody, Massachusetts  
 Bulsara, Ketan R. (Davidson), Charlotte, North Carolina  
 Busquets, Miguel A. (Harvard), Ponce, Puerto Rico  
 Camacho, Daniel L. (Stanford), Gretna, Louisiana  
 Chambers, Robert A. (Centre), Campbellsville, Kentucky  
 Chang, Albert S. (Michigan at Ann Arbor), Morgantown, West Virginia  
 Cheng, Elbert T. (Stanford), Mountain View, California  
 Chui, Stephen Y. (Stanford), Durham, North Carolina  
 Clowse, Martin C. (Duke), Greensboro, North Carolina  
 Colvin, Richard A. (Cornell), Virginia Beach, Virginia  
 Crowley, Steven D. (Harvard), Columbus, Georgia  
 Cusmarium, Jeffrey R. (Union), West Orange, New Jersey  
 Datto, Michael B. (Johns Hopkins), Cherry Hill, New Jersey  
 Dauterman, John F. (Duke), Raleigh, North Carolina  
 Della Rocca, Gregory J. (Cornell), Castleton, New York  
 Di Renzo, Gina (Notre Dame), Flanders, New Jersey  
 DiCuccio, Michael N. (Duke), Durham, North Carolina  
 Downey, William E., III (Duke), Durham, North Carolina  
 Durgin, Harry W., Jr. (Duke), Huntsville, Alabama  
 Eaton Jones, Suzanne E. (Howard), Durham, North Carolina  
 Ellis, Susan W. (Yale), Atlanta, Georgia  
 Eng, Michael A. (Maryland), Cooksville, Maryland  
 Erens, Greg (Duke), Northbrook, Illinois  
 Evanoff, Allison M. (Washington Jefferson), Durham, North Carolina  
 Fetko, Linda L. (United States Military Academy), Durham, North Carolina  
 Fields, Michael J. (Pennsylvania), Silver Spring, Maryland  
 Fields, Timothy A. (Chicago), Crowley, Louisiana  
 Flynn, Matthew K. (Harvard), Durham, North Carolina  
 Flynn, Theresa McCarthy (Howard), Durham, North Carolina  
 Fralix, Teresa A. (Duke), Durham, North Carolina  
 Galdino, Gregory M. (Pennsylvania State), Camp Hill, Pennsylvania  
 Gamard, Christopher J. (Duke), New Orleans, Louisiana  
 Gilliam, Lisa K. (Amherst), Durham, North Carolina  
 Hage, William D. (Kenyon), Durham, North Carolina  
 Haisley, Camille A. (Akron Main Campus), Canton, Ohio  
 Hamilton, Penny Jo (West Virginia), Fairmont, West Virginia  
 Haque, Tehmina (Princeton), St. James, New York  
 Hardacre, Jeffrey M. (Wisconsin at Madison), Marshfield, Wisconsin  
 Hardee, Michael W. (North Carolina at Chapel Hill), Carrboro, North Carolina  
 Hare, Charles B. (West Virginia), Morgantown, West Virginia  
 Hepburn, Matthew J. (Duke), Ann Arbor, Michigan  
 Higgins, Peter Doyle (Duke), Durham, North Carolina  
 Holmes, Jude Jr. (North Carolina at Chapel Hill), Maple Hill, North Carolina  
 Horowitz, Neil S. (North Carolina at Chapel Hill), Charlotte, North Carolina  
 Howard, Gayle C. (California at San Diego), Durham, North Carolina  
 Huang, David Y. (Duke), Carrboro, North Carolina  
 Jacobucci, Mark J. (George Mason), Poquoson, Virginia  
 Jacobs, Michael T. (South Florida), Bradenton, Florida  
 Johnson, Beth Gibbs (William Marsh Rice), Fort Bragg, North Carolina  
 Jones, Thomas E. (Boston), Billings, Montana  
 Kadrmas, Warren R. (United States Air Force), Sheridan, Wyoming  
 Kang, Esther H. (Wellesley), Canton, Ohio  
 Kaplan, Seth D. (Cornell), Harriman, New York  
 Kelly, Bryan T. (Brown), West Redding, Connecticut  
 Kenan, Daniel J. (William and Mary), Durham, North Carolina  
 Kim, Dennis M. (Brown), White Oak, Pennsylvania  
 Kraus, John E., Jr. (Florida), Cherry Hill, New Jersey  
 Krol, Bryan J. (Indiana at Bloomington), Cincinnati, Ohio  
 Lapp, Julie A. (Cornell), Durham, North Carolina  
 Larson, Sara E. (Princeton), Dunwoody, Georgia  
 Lee, David M. (Stanford), Fosston, Minnesota  
 Lee, Linda H. (Smith), Glendale, Wisconsin  
 Liao, Lawrence (Duke), Laurinburg, North Carolina  
 Mansbach, Jonathan M. (Haverford), Memphis, Tennessee



Marathe, Umesh S. (Duke), Amherst, New York  
 Marshak, Jennifer D. (Pennsylvania), Dix Hill, New York  
 May, Christopher W. (Brown), Rochester, New York  
 McGuire, Carla A. (Howard), Ithaca, New York  
 McMurry, Michelle Taylor (Harvard), Oakland, California  
 Melnick, Jeffrey R. (Princeton), Danville, Virginia  
 Michelson, Kelly N. (Columbia), St. Louis, Missouri  
 Moore, Lisa E. (Southern University A & M), Bastrop, Louisiana  
 Morgan, Brian E. (Swarthmore), Nashotah, Wisconsin  
 Mostaghel, Elahe A. (Harvard), Toledo, Ohio  
 Murata, Yoshihiko (Stanford), Durham, North Carolina  
 Nash, S. Russell (Wake Forest), Belton, South Carolina  
 Nasser, Rima M. (Johns Hopkins), Athens, Greece  
 Neimat, Joseph S. (Dartmouth), Potomac, Maryland  
 Newman, Ann E. (Duke), Chapel Hill, North Carolina  
 Norris, Edward R. (Massachusetts Institute of Technology), Greenville, North Carolina  
 Norvell, Kirstina E. (Yale), Potomac, Maryland  
 Ong, Ricardo Completa (Rochester), Ringwood, New Jersey  
 Paydarfar, Joseph A. (Duke), Chapel Hill, North Carolina  
 Pazin, John G. (Pennsylvania), Pittsburgh, Pennsylvania  
 Petti, Cathy A. (Harvard), Nutley, New Jersey  
 Pradhan, Archana A. (Princeton), Durham, North Carolina  
 Prosnitz, Robert G. (Yale), Chapel Hill, North Carolina  
 Putman, Shannon B. (Virginia), Chapel Hill, North Carolina  
 Quan, Long T. (Indiana), Indianapolis, Indiana  
 Quarterman, Renee L. (Brown), Wilmington, Delaware  
 Rao, Bhagwan J. (Johns Hopkins), Dunn, North Carolina  
 Rothman, Russell L. (Duke), Albertson, New York  
 Routbort, Mark J. (Chicago), Darien, Illinois  
 Royster, Michael O. (Virginia), Burke, Virginia  
 Schreiber, Jonathan L. (Stanford), Dix Hills, New York  
 Shapiro, Leonid (Cornell), Rochester, New York  
 Spencer, Edwin E., Jr. (North Carolina State), Wilmington, North Carolina  
 Steele, Thomas M. (Oberlin), Durham, North Carolina  
 Stekler, Joanne D. (Williams), Bethesda, Maryland  
 Sumner, William T. (Duke), Chapel Hill, North Carolina  
 Tchao, Nadia K. (California at Berkeley), West Auburn, Maine  
 Tevrizian, Allyson T. (Duke), Pasadena, California  
 Trammel, Demaree L. (American), Rochester, New York  
 Verbinski, Steven G. (Stanford), San Diego, California  
 Wang, Feng Lei (Princeton), Oak Ridge, Tennessee  
 Weinberg, Jason B. (Princeton), Durham, North Carolina  
 Weinberg, Mark A. (Yale), Boca Raton, Florida  
 Wimmer, Alan P. (Brigham Young), Logan, Utah  
 Wong, Carolyn (Stanford), Walnut Creek, California  
 Wu, Ming Y. (Stanford), Mountain View, California  
 Xanthakos, Stavra A. (Duke), Maumee, Ohio  
 Yeh, Benjamin M. (Harvard), Tenafly, New Jersey  
 Yeh, Mark M. (Dartmouth), Bakersfield, California  
 Yelverton, Cheryl L. (California State-Northridge), Pacoima, California  
 Young, Timothy N. (Duke), Durham, North Carolina  
 Yu, Paul B. (Stanford), Williamsville, New York

### **Class of 1997**

Ard, Jamy D. (Morehouse), Grambling, Louisiana  
 Asplin, Iain R. (Virginia), Charlottesville, Virginia  
 Bailey, Steven R. (Yale), Dayton, Ohio  
 Barth, Rolf N. (Duke), Durham, North Carolina  
 Becker, Sylvia I. (Cornell), Syosset, New York  
 Berend, Keith R. (Florida Southern), Durham, North Carolina  
 Bliss, Sandra J. (Stanford), River Forest, Illinois  
 Bloom, Matthew B. (Massachusetts Institute of Technology), Chappaqua, New York  
 Boley, Elena (Amherst), Washington, District of Columbia  
 Brady, Todd C. (Dartmouth), Winston-Salem, North Carolina  
 Callanan, Lawrence D., Jr. (Williams), Williamstown, Massachusetts  
 Callister, Matthew D. (Brigham Young), La Canada, California  
 Chatterjee, Rane (Vanderbilt), Knoxville, Tennessee

Coggins, Claire A. (Pennsylvania State), West Chester, Pennsylvania  
 Collard, Harold R., Jr. (Harvard), Mountain View, California  
 Colvin, Larry G. (North Carolina at Chapel Hill), Durham, North Carolina  
 Cook, Marcus P. (Davidson), Charlotte, North Carolina  
 Corcoran, Ethan E. (Cornell), Pennington, New Jersey  
 Courtney, Kevin D. (Dartmouth), Keene, New Hampshire  
 Criscione, Lisa G. (Duke), Durham, North Carolina  
 Diers, Tiffany L. (Duke), Durham, North Carolina  
 Duncan, James E. (Duke), New Port News, Virginia  
 Dunn, Toby J. (Texas at Austin), Frisco, Texas  
 Dyer, Sara L. (George Washington), Torrence, California  
 Eizember, Frances L. (Michigan at Ann Arbor), Chapel Hill, North Carolina  
 Fernandez, Adolfo Z., Jr. (Georgetown), Miami, Florida  
 Fernando, Nishan H. (Duke), Stone Mountain, Georgia  
 Finch, Michael R. (Stanford), Moreland Hills, Ohio  
 Gills, James P., III (Vanderbilt), Palm Harbour, Florida  
 Graham, Robert D., II (Massachusetts Institute of Technology), Maryville, Tennessee  
 Grubbs, Vanessa (Duke), Spring Lake, North Carolina  
 Ha, Tuan X. (Yale), Brookline, Massachusetts  
 Halpern, Michael A. (Yale), La Canada, California  
 Harris, Jason B. (Wesleyan), North Hampton, Massachusetts  
 Hawkins, Richard D. (North Carolina at Chapel Hill), Belhaven, North Carolina  
 Henderson, Phillippa J. (Duke), Durham, North Carolina  
 Horn, Meyer A. (Texas at Austin), Memphis, Tennessee  
 Horton, Claire K. (Duke), Durham, North Carolina  
 Huang, Erich S. (Harvard), Durham, North Carolina  
 Huang, Joy Y. (Stanford), Voorhees, New Jersey  
 Huffman, George R. (Davidson), Orlando, Florida  
 Hurwitz, Lynn M. (Haverford), Durham, North Carolina  
 Jackson, Doniel L. (Duke), St. Charles, Illinois  
 Jacobs, Jason M. (Harvard), Baldwin, New York  
 Jones, Adrie D. (Duke), Durham, North Carolina  
 Joneschild, Elizabeth S. (Stanford), Mercer Island, Washington  
 Kazaks, Emily L. (Duke), Bradenton, Florida  
 Kwak, Eunice L. (Stanford), Winston-Salem, North Carolina  
 Lamvu, Georgine M. (Duke), Durham, North Carolina  
 Lane, William H. (Harvard), Champaign, Illinois  
 LaRocque, Regina C. (Emory), Merritt Island, Florida  
 Locklear, Robert W., Sr. (Duke), Durham, North Carolina  
 Mallory, Mark A. (Amherst), Littleton, Colorado  
 Mathy, Christian B. (Stanford), Sugar Land, Texas  
 Mauskopf, Alice E. (Cornell), Durham, North Carolina  
 McAllister, Ann K. (Davidson), Wilmington, North Carolina  
 McCarty, David E. (Virginia), Koloa, Hawaii  
 McDonough, Kelly J. (Syracuse), Woodstock, New York  
 McFadden, Dwight J. (Goshen), Durham, North Carolina  
 Meyer, Jennifer L. (Duke), Pine Island, Minnesota  
 Miles, Joseph S. (Duke), Maplewood, New Jersey  
 Mitchell, Duane A. (Rutgers), Somerset, New Jersey  
 Montgomery, Sean P. (Johns Hopkins), White Hall, Maryland  
 Musgrave, Douglas S. (Oregon), Grand Junction, Colorado  
 Nelson, Caleb P. (Dartmouth), Falmouth, Maine  
 Nelson, Robert E. (Princeton), Rochester, New York  
 Neyman, Eduard G. (Miami), West Palm Beach, Florida  
 Norris, Shannon D. (Duke), Taylors, South Carolina  
 Onaitis, Mark W. (Harvard), Pittsburgh, Pennsylvania  
 Owen, Sylvia A. (Ambassador), Coos Bay, Oregon  
 Pascoe, Catherine L. (Stanford), Durham, North Carolina  
 Purow, David B. (Brown), Staten Island, New York  
 Quan, Hai N. (Indiana at Bloomington), Indianapolis, Indiana  
 Rao, Dinesh S. (Pennsylvania), Murphy, North Carolina  
 Rose, John G., Jr. (Dartmouth), Rumson, New Jersey  
 Rosenthal, Lisa G. (Virginia), Norfolk, Virginia  
 Saito, Stacey Y. (Texas at Austin), Chapel Hill, North Carolina  
 Sebastian, Brian M. (Duke), North Wilkesboro, North Carolina  
 Seo, David M. (Duke), Greensboro, North Carolina  
 Solga, Steven F. (Cornell), Orwigsburg, Pennsylvania

Spratt, Sarah S. (Oberlin), Washington, District of Columbia  
 Srinivasan, Meera (Case Western Reserve), Winter Springs, Florida  
 Stubbs, Allston J., IV (North Carolina at Chapel Hill), Winston-Salem, North Carolina  
 Sullivan, Daniel P. (Stanford), Sparta, New Jersey  
 Sundin, Burton M. (Duke), Virginia Beach, Virginia  
 Sung, Jenny C. (Cornell), Mountainside, New Jersey  
 Tong, David C. (Duke), Albany, Georgia  
 Tucker, Virginia M. (Phoenix), Efland, North Carolina  
 Tull, Frank, IV (Dartmouth), Muskogee, Oklahoma  
 Wahl, Tanya (Washington), Lynnwood, Washington  
 Watrous, Susan M. (Vassar), Vestal, New York  
 Wee, Jonny O. (Harvard), Las Vegas, Nevada  
 Weeks, Howard R., III (North Carolina State), Charlotte, North Carolina  
 White, Rebekah Ruth (Stanford), Charlotte, North Carolina  
 White, Wendy M. (Case Western Reserve), Durham, North Carolina  
 Wong, Christine (Yale), Bethesda, Maryland  
 Yacoubian, Talene A. (Harvard), Chattanooga, Tennessee  
 Yen, Michael H. (Harvard), Hanover, New Hampshire  
 Yoo, David S. (Duke), Spring, Texas  
 Youngblood, Scot A. (Duke), Durham, North Carolina

### **Class of 1998**

Adlakha, Charu L. (Massachusetts Institute of Technology), Columbia, Maryland  
 Ahuja, Vinita (Duke), Raleigh, North Carolina  
 Allen, Jayne D. (Indiana at Bloomington), Salem, Indiana  
 Anderson, Scott R. (Duke), Reston, Virginia  
 Baek, Peter S. (Johns Hopkins), James Island, South Carolina  
 Bartholomew, Marnie B. (Bucknell), Shillington, Pennsylvania  
 Batten, Dean (North Carolina at Chapel Hill), Smithfield, North Carolina  
 Berry, Garland K. (David Lipscomb), Lebanon, Tennessee  
 Beutler, Anthony L. (Brigham Young), Orem, Utah  
 Bienstock, Alan M. (Duke), E. Windsor, New Jersey  
 Black, Stephanie M. (Johns Hopkins), Olympia, Washington  
 Blatt, Ellen R. (Duke), Durham, North Carolina  
 Bolden, Jason E. (Minnesota-Morris), Charlotte, North Carolina  
 Bolognesi, Michael (North Carolina at Chapel Hill), Durham, North Carolina  
 Bright, Cheryl L. (Yale), Durham, North Carolina  
 Brodsky, Michael C. (Massachusetts Institute of Technology), Melville, New York  
 Bronstein, David M. (Manitoba), Chapel Hill, North Carolina  
 Brown, Franchesca D. (Duke), Myrtle Beach, South Carolina  
 Bryce, Thomas J. (Amherst), Belle Harbor, New York  
 Byerley, Julie S. (Rhodes), Durham, North Carolina  
 Chandler, Damon B. (Duke), New Hyde Park, New York  
 Cooper, Leslie W. (Georgia State), Chapel Hill, North Carolina  
 Dike, Nwamara C. (Maryland-College Park), Hyattsville, Maryland  
 Dixon, Terry C. (South Carolina at Columbia), Aynor, South Carolina  
 Drayer, Jeffrey, (Cornell), East Brunswick, New Jersey  
 Farooki, Aamer Z. (Harvard), Demarest, New Jersey  
 Gagliardi, Jane P. (Brown), Athol, Massachusetts  
 Garg, Seema (Duke), Durham, North Carolina  
 Gesty-Palmer, Diane (Oberlin), Durham, North Carolina  
 Gratz, Brett I. (Duke), Durham, North Carolina  
 Green, Jonathan S. (North Carolina at Chapel Hill), Burnsville, North Carolina  
 Greene, Jeffrey (Grinnell), Durham, North Carolina  
 Gullotto, Carmelo (Miami), Homestead, Florida  
 Halvorson, Eric G. (Bates), Maplewood, New Jersey  
 Hanft, Valerie N. (Duke), Chapel Hill, North Carolina  
 Hanley, Matthew L. (Holy Cross), Chapel Hill, North Carolina  
 Hickey, Jason D. (Colgate), Norcross, Georgia  
 Hsia, Amie W. (Harvard), Potomac, Maryland  
 Hu, Gang (Davidson), Durham, North Carolina  
 Hughes, Solon G. (North Carolina at Chapel Hill), Durham, North Carolina  
 James, Martha L. (Swarthmore), Hillsborough, North Carolina  
 Jenkins, Joanne M. (Wellesley), Westford, Massachusetts  
 Kahl, Christina R. (Dartmouth), Winston-Salem, North Carolina  
 Kahn, Elizabeth S. (Yale), Shrewsbury, New Jersey  
 Kalady, Matthew F. (Harvard), Allentown, Pennsylvania  
 Killian, Jonathan K. (Stanford), Saratoga, California



King, Aliceson Y. (Maryland Baltimore County), Baltimore, Maryland  
 King, Wendalyn K. (Alabama), Peachtree City, Georgia  
 Knize, Leisha M. (Claremont McKenna), Englewood, Colorado  
 Kong, James A. (Duke), Dayton, Ohio  
 Lager, Patrick J. (Whitman), Shelby, Montana  
 Lahey, Timothy P. (Georgetown), Salt Lake City, Utah  
 Lee, Kenneth J. (Duke), Charlotte, North Carolina  
 Levinson, Bari E. (California-Davis), Rancho Murieta, California  
 Lien, Lillian F. (Harvard), Germantown, Maryland  
 Littman, Eva D. (Duke), New Bern, North Carolina  
 Lyons, Michael S. (Northwestern), Libertyville, Illinois  
 Massenburg, Donald (Haverford), Durham, North Carolina  
 McClure, Matthew W. (California-San Diego), Las Vegas, Nevada  
 McDonald, Brian M. (Notre Dame), Webster, Texas  
 Meine, Trip J. (Yale), Columbus, Georgia  
 Morowitz, Michael J. (Dartmouth), Cherry Hill, New Jersey  
 Nettles, Richard E. (Notre Dame), Wadsworth, Ohio  
 Obadiah, Joseph M. (Duke), Greensboro, North Carolina  
 Pande, Ashvin N. (Harvard), Braintree, Massachusetts  
 Park, Eun-Ha (Yale), Pacific Grove, California  
 Patil, Chandrashek Y. (North Carolina at Chapel Hill), Charlotte, North Carolina  
 Phillips, Harmony K. (Colgate), Carrboro, North Carolina  
 Powell, Jeffrey C. (Colgate), Worthington, Ohio  
 Price, Nicole (Baylor), Houston, Texas  
 Reeck, Jay B. (Pomona), Mercer Island, Washington  
 Reuter, Nancy (Emory), Vero Beach, Florida  
 Roberts, O. Adetola (South Carolina at Columbia), Columbia, South Carolina  
 Rougier-Chapman, Duncan P. (Duke), Durham, North Carolina  
 Samuelson, David W. (Vanderbilt), Birmingham, Alabama  
 Sarraf-Yazdi, Shiva (Duke), Durham, North Carolina  
 Scarborough, John E. (Georgetown), Raleigh, North Carolina  
 Shah, Jita C. (North Carolina at Chapel Hill), Cary, North Carolina  
 Smith, Rachelle A. (North Carolina at Chapel Hill), Durham, North Carolina  
 Smoak, Charles K. (Duke), Charlotte, North Carolina  
 Soltani, Lisa F. (Evergreen State), Bothell, Washington  
 Song, Alice (Massachusetts Institute of Technology), Oak Brook, Illinois  
 Sorensen, Carsten M. (Duke), Greensboro, North Carolina  
 Stolker, Joshua M. (Duke), Gaithersburg, Maryland  
 Taylor, Jennifer L. (Stanford), Aurora, California  
 Thornburg, Courtney D. (Duke), Okemos, Michigan  
 Vanscoy, Lori L. (United States Naval Academy), French Creek, West Virginia  
 Wadleigh, Martha (Dartmouth), Manchester, New Hampshire  
 Walker, David H. (Washington), Lees Summit, Missouri  
 Warren, Kristi J. (North Carolina State), Garner, North Carolina  
 Weaver, Carolyn J. (Cornell Endowed Colleges), Fayetteville, North Carolina  
 Weiser, Lori (Stanford), New City, New York  
 Wheeler, Kevin G. (Florida), Ft. Meyers, Florida  
 Whitener, Tracy R. (Duke), Lenoir, North Carolina  
 Wiener, Douglas J. (Pennsylvania), Great Neck, New York  
 Williamson, John A. (Dartmouth), Austin, Texas  
 Wilson, Russell C. (Duke), Irving, Texas  
 Wong, David (Duke), York, Pennsylvania  
 Wood, Carrie E. (Emory), Memphis, Tennessee  
 Wu, Ning, Z. (Peking-China), Chapel Hill, North Carolina  
 Yoder, Daniel M. (John Brown), Mt. Pleasant, Iowa  
 Zidar, David A. (Notre Dame), Pittsburgh, Pennsylvania

## Class of 1994 with Postgraduate Year One Appointment\*

Key: Student, Name, Hometown, Internship Institution and Discipline (if applicable), City and State, Residency Institution and Discipline, City and State, Ultimate Career Choice.

- Aaron, Rosemary Hunter (Tallahassee, Florida) University of Alabama, Birmingham, Alabama—Pediatrics
- Abernethy, Amy Pickar (Maitland, Florida) Duke University Medical Center, Durham, North Carolina—Hematology/Oncology
- Anderson, Karen Sue (Wilmington, Delaware) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine
- Arnder, Lance Lee (Goldsboro, North Carolina) University of North Carolina, Chapel Hill, North Carolina—Radiology
- Arnold, W. Davis, Jr. (Bristol, Virginia) University of Alabama, Birmingham, Alabama—General Medicine
- Banit, Daxes Mohan (Atlanta, Georgia) Vanderbilt University, Nashville, Tennessee—Surgery
- Bazar, Kimberly Ann (Madison, Connecticut) University of California, San Francisco, California—Internal Medicine—Dermatology
- Benjamin, Arthur (Forest Hills, New York) University of California, Harbor—Transitional, University of California, Los Angeles, California—Ophthalmology
- Blair, David Russell (Sterling, Virginia) Womack Army Medical Center, Fort Bragg, North Carolina—Family Medicine Group Practice
- Bowman, Brock K. (Los Gatos, California) Georgia Baptist Hospital, Atlanta, Georgia—Transitional; Baylor University, Houston, Texas—Physical and Rehabilitation Medicine
- Britt, James Woodrow (Durham, North Carolina), University of North Carolina, Chapel Hill, North Carolina—Pediatrics
- Britt, John Calvin (Elizabethtown, North Carolina) University of Virginia, Charlottesville, Virginia—Surgery—Otolaryngology
- Brown, Rachel Amy (New Orleans, Louisiana) University of North Carolina, Chapel Hill, North Carolina—Internal Medicine
- Bullard, Steven Redding (Charlotte, North Carolina), Riverside Regional Medical Center, Riverside, Virginia—Transitional; Vanderbilt University Medical Center, Nashville, Tennessee—Ophthalmology
- Buranosky, Raquel A. (Franklin, Pennsylvania) University Health Center, Pittsburgh, Pennsylvania—Internal Medicine
- Cabell, Christopher Hayden (Clarence, New York) Duke University Medical Center, Durham, North Carolina—Internal Medicine/Hematology-Oncology/Cardiology
- Chai, Paul Jubeong (Holmdel, New Jersey) Duke University Medical Center, Durham, North Carolina—Cardiac Surgery
- Chen, Frederick (Marshfield, Wisconsin) University of Iowa, Iowa City, Iowa—Interventional Radiology
- Chu, Charleen Tan-Ching (Carson, California) Duke University Medical Center, Durham, North Carolina—Academic Pathology
- Clark, Carolyn A. (Cumberland, Rhode Island) University of Cincinnati Hospital, Cincinnati, Ohio—Academic Medicine—Pediatrics
- Clark, Dwayne Charles (Hialeah, Florida) Jacksonville Naval Hospital, Jacksonville, Florida—Navy Family Practitioner
- Donnelly, Daniel Scott (Newfoundland, New Jersey) University of California, Los Angeles, California—Pathology—Undecided
- Dugas, Jeffrey Raymond (Charlotte, North Carolina) University of North Carolina, Chapel Hill, North Carolina—Surgery; Hospital for Special Surgery, New York, New York—Orthopaedic Surgery
- Eaton, James Van (Durham, North Carolina) Duke University Medical Center, Durham, North Carolina—Surgery—Academic Urologic Oncology
- El-Shammaa, Emile N. (Rockville, Maryland) Ohio State University, Columbus, Ohio—Emergency Medicine
- Englert, Judith Stenftenagel (Jasper, Indiana) Carilion Health Systems, Roanoke, Virginia—Transitional; Duke University Medical Center, Durham, North Carolina—Ophthalmology
- Esposito, David John (Milford, Connecticut) Rush-Presbyterian-St. Lukes Hospital, Chicago, Illinois—Cardiothoracic Surgery
- Fard, Arman (King of Prussia, Pennsylvania) Roanoke Memorial Hospital, Roanoke, Virginia; Johns Hopkins University, Baltimore, Maryland—Academic Ophthalmology

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\*Hometown does not denote legal residence.

Floberg, Dane Robert (Denver, Colorado) St. Joseph Hospital, Denver, Colorado—Family Practice/Sports Medicine

Fortuin, Brian Wallace (Danville, California) University of Washington Medical Center, Seattle, Washington—General Internal Medicine

Friedman, Antony (Brooklyn, New York) Barnes Hospital—Washington University, St. Louis, Missouri—Surgery

Ganchi, Parham A. Ganchi (Wayne, New Jersey) Brigham and Women's Hospital, Boston, Massachusetts—Surgery

Gillespie, Richard R., Jr. (Charlotte, North Carolina) University of Texas—Southwestern Medical School, Dallas Texas—General Surgery—Otolaryngology

Goldstein, Jeffrey Brian (Bridgewater, New Jersey) Tucson Medical Center, Tucson, Arizona—Transitional; Emory University Medical Center, Atlanta, Georgia—Ophthalmology

Greene, Deborah Reynolds (New York, New York) Oakland Children's Hospital, Oakland, California—Pediatrics

Ha, Van Trong (Springfield, Virginia) University of California, Mount Zion, San Francisco, California—Medicine—Dermatology

Harrison, Cary Elizabeth (Denver, Colorado) United States Naval Hospital, San Diego, California—Transitional—Ophthalmology

Hasselmann, Carl Thomas (Saint Mary's, Pennsylvania) University Health Center of Pennsylvania, Pittsburgh, Pennsylvania—Orthopaedic Surgery

Hasty, Christopher Clay (Goldsboro, North Carolina) Methodist Hospital—Transitional; Campbell Clinic, Memphis, Tennessee—Orthopaedic Surgery

Haura, Eric Bruce (Bridgewater, New Jersey) Johns Hopkins Hospital, Baltimore, Maryland—Cardiology or Medical Oncology

Hester, Mark Anthony Hester (Elizabethtown, North Carolina) Duke University Medical Center, Durham, North Carolina—Neurosurgery

Hoffman, Robert Dow (Jacksonville, Florida) University of Iowa, Iowa City, Iowa—Orthopaedic Surgery

Huang, Patti Chia-Sue Huang (Chapel Hill, North Carolina) Duke University Medical Center, Durham, North Carolina—Surgery—Otolaryngology

Hunter, Jennifer Lynn (Plainfield, New Jersey) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine—Dermatology

Jenkins, Harvey Clarke, Jr. (Fayetteville, North Carolina) West Virginia University Hospitals, Morgantown, West Virginia—Orthopaedics—Academic Physician—Biochemistry Research

Kauffman, Kimberly Susan (Titusville, New Jersey) University of Michigan Hospitals, Ann Arbor, Michigan—Obstetrics and Gynecology

Kaynan, Ayal M. (Holliswood, New York) Mayo Clinic, Rochester, Minnesota—Surgery

Keogh, Maureen Langdon (Norwalk, Connecticut) University of California, San Francisco, California—General Internal Medicine

Kevill, Katharine Anne (Babylon, New York)—Undecided—Pediatrics

Kirk, Kevin P. (Herkimer, New York) Vanderbilt University Medical Center, Nashville, Tennessee—Internal Medicine

Lee, Maggie Cho (San Pedro, California) Brigham and Women's Hospital, Boston, Massachusetts—General Surgery

Lee, Robert E. (Indianapolis, Indiana) Mercy Hospital, Pittsburgh, Pennsylvania—Transitional; University of Pittsburgh, Pittsburgh, Pennsylvania—Ophthalmology

LeMosy, Ellen Kay (Melbourne, Florida)—Residency Deferred—Research in Cell/Developmental Biology

Lucas, Gregory Michael (Deerfield, Illinois) Johns Hopkins Hospital, Baltimore, Maryland—Internal Medicine

Lukes, Andrea Steele (Asheville, North Carolina) University of North Carolina, Chapel Hill, North Carolina—Obstetrics & Gynecology—Reproductive Endocrinology

Lynch, John Roborg (Grafton, Virginia) Duke University Medical Center, Durham, North Carolina—Internal Medicine—Neurology

Malchow, Steven Carl (St. Louis, Missouri) Duke University Medical Center, Durham, North Carolina—Radiology

Mass, Stephen Christopher (Plantation, Florida) McGaw Medical Center, Northwestern University, Chicago, Illinois—Surgery—Otolaryngology

Maybodi, Mitra (Tehran, Iran) Duke University Medical Center, Durham, North Carolina—Internal Medicine; Washington University Medical Center, St. Louis, Missouri—Ophthalmology

McFarland, Barbra Jill (Indian Wells, California) Children's Hospital of Philadelphia, Philadelphia, Pennsylvania—Academic Pediatrics—Research

McSwain, Mark Wyatt (Wilmington, North Carolina) University of Rochester Medical Center, Rochester, New York—Internal Medicine/Pediatrics Community Practice

Mehran, Amir-Hossein (Tehran, Iran) University of California, San Francisco, California—General Surgery



Mellin, Andrew Foster (Fort Lauderdale, Florida) Barnes Hospital- Washington University, St. Louis, Missouri-Internal Medicine

Monks, John Edwin (Holden, Massachusetts) University of California- Mount Zion-Internal Medicine; University of California, San Francisco, California-Anesthesiology

Murthy, Thippeswamy H. (Pittsburgh, Pennsylvania) University of Michigan, Ann Arbor, Michigan-Internal Medicine-Gastroenterology

Naslund, Patricia Keogh (Norwalk, Connecticut) Jewish Hospital - Washington University Medical Center, St. Louis, Missouri-Internal Medicine-Neurology

Nazaire, Fausta (Queens Village, New York) Brigham and Women's Hospital, Boston, Massachusetts-Internal Medicine

Oury, Tim David (Valparaiso, Indiana) Duke University Medical Center, Durham, North Carolina-Pulmonary Pathology

Padin, Cheryl J. (Franklin, Pennsylvania) University of Michigan, Ann Arbor, Michigan-Obstetrics and Gynecology

Pak, Wanda (Durham, North Carolina) Spartanburg Regional Medical Center, Spartanburg, South Carolina-Transitional; Vanderbilt University Medical Center, Nashville, Tennessee-Ophthalmology

Payne, George Braxton (Durham, North Carolina) University of Michigan, Ann Arbor, Michigan-Pediatrics

Piglia, Lisa Marie (Raleigh, North Carolina) Texas Children's Hospital at Baylor College of Medicine, Houston, Texas-Pediatric Infectious Disease

Filler, Christopher Patrick (Cobleskill, New York) Strong Memorial Hospital - University of Rochester, Rochester, New York-Orthopaedic Surgery

Register, Brian Sean (Sumter, South Carolina) Duke University Medical Center, Durham, North Carolina-Obstetrics and Gynecology

Rimmele, Frederick Charles III (Clifton, New Jersey) Maine - Dartmouth Family Practice Center, Augusta, Maine-Family Medicine

Roland, Frank Hancock, Jr. (Greensboro, North Carolina) Duke University Medical Center, Durham, North Carolina-Surgery-Urology

Rouleau, Peggy Alicia (Duluth, Minnesota) Mayo Clinic, Rochester, Minnesota-Diagnostic Radiology

Sam, Albert Devon II (New Orleans, Louisiana) University of Illinois, Chicago, Illinois-Surgery-Plastic and Reconstructive Surgery

Schaffer, James William (Charlotte, North Carolina) United States Naval Hospital, Bremerton, Washington-Family Medicine

Schneider, Andrew Martin (Suffern, New York) Duke University Medical Center, Durham, North Carolina-Internal Medicine-Diagnostic Radiology

Schoenfeld, David Eric (Thiells, New York) Duke University Medical Center, Durham, North Carolina-Internal Medicine-Dermatology

Sheifer, Stuart Ethan (Potomac, Maryland) Johns Hopkins Hospital, Baltimore, Maryland-Internal Medicine-Cardiology

Siegfried, Marion E. (Hilltown, Pennsylvania) Children's Memorial Hospital, Chicago, Illinois-Pediatrics; Northwestern University Medical Center, Chicago, Illinois-Pediatrics

Smith, Darin Scott (Sandusky, Ohio) Roanoke Memorial Hospital, Roanoke, Virginia-Transitional; University of Texas - Southwestern, Dallas, Texas-Ophthalmology-Academic and Group Practice

Sonny, Marya (Syosset, New York) North Shore University Hospitals, Manhasset, New York-Internal Medicine; Johns Hopkins Hospital, Baltimore, Maryland-Anesthesiology

Spraggins, Yolanda Richelle (Detroit, Michigan) University of Cincinnati Hospital, Cincinnati, Ohio-Pediatrics

Srebro, Sharon Handy (North Wilkesboro, North Carolina) Duke University Medical Center, Durham, North Carolina-Diagnostic Radiology

Stambaugh, Lloyd Edwin III (Hallsville, Missouri) Washington University Medical Center, St. Louis, Missouri-Radiology

Stone, Kimberly Anne Crapo (Chapel Hill, North Carolina) University of Texas-Southwestern Medical Center, Dallas, Texas-Internal Medicine

Sublett, Toni Denise (Altadena, California) Johns Hopkins University, Baltimore, Maryland-Internal Medicine-Cardiology

Sumner, Sean Maxwell (Scarborough, Ontario, Canada) Chattanooga Unit-University of Tennessee College of Medicine, Chattanooga, Tennessee-Transitional; Duke University Medical Center, Durham, North Carolina-Anesthesiology

Swett, Jay W. (Pittsburgh, Pennsylvania) University of Michigan Hospitals, Ann Arbor, Michigan-Surgery

Thompson, Joffrey G. (Grand Forks, North Dakota) University of Iowa Hospitals and Clinics, Iowa City, Iowa-Orthopaedics

Toth, Alison P. (New Fairfield, Connecticut) Duke University Medical Center, Durham, North Carolina-Surgery-Orthopaedic Oncology

Trauner, Michael Allen (Sunnyvale, California) Kaiser Permanente, Santa Clara, California-Internal Medicine; Stanford University Medical Center, Palo Alto, California-Anesthesiology

Tsai, Donald Edward (Bethesda, Maryland) Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania-Internal Medicine-Academic Medicine

Turner, Michael Brent (Clearwater, Florida) Yale-New Haven Medical Center, New Haven, Connecticut-Internal Medicine-Dermatology

Via, Dan Forrest (Durham, North Carolina) University of North Carolina, Chapel Hill, North Carolina-Pediatrics; Duke University Medical Center, Durham, North Carolina-Pediatric Anesthesiology

Wong, Cindy Van Le (Honolulu, Hawaii) Stanford University Hospital, Palo Alto, California-Pediatrics

Woodard, Lawrence, Jr. (Grambling, Louisiana) Mt. Sinai Medical Center, Cleveland, Ohio-Transitional; University of Pennsylvania, Pittsburgh, Pennsylvania-Clinical Ophthalmology

Woods, Christopher Wildrick (Atlanta, Georgia) Duke University Medical Center, Durham, North Carolina-Internal Medicine

Woolley, Charles Todd (Zionsville, Pennsylvania) Medical Center Hospitals of Vermont, Burlington, Vermont-General Surgery-Orthopaedic Surgery

Wu, Richard Chao-Chung (Salisbury, North Carolina) Johns Hopkins Hospital, Baltimore, Maryland-Internal Medicine-Cardiology

Wurst, Eric Alan (Asheville, North Carolina) University of Cincinnati, Cincinnati, Ohio-Medicine/Pediatrics

Yelin, Julie Beth (Houston, Texas) University of South Florida, Tampa, Florida-General and Plastic Surgery-Craniofacial Reconstructive Surgery

Yun, A. Joon (Rockville, Maryland) Kaiser Permanente, San Francisco, California-Internal Medicine; Stanford University Hospitals, Palo Alto, California-Radiology





# *School of Nursing*



## **The Duke University School of Nursing**

The Duke University School of Nursing provides leadership in the health care of people through education, research and health care delivery. We provide advanced and comprehensive education to prepare students for lifetimes of learning and careers as leaders, practitioners or as researchers. In addition, faculty and students conduct research that adds to our understanding of health promotion and illness prevention, human responses to illness, and systems of care that facilitate better patient outcomes; and through their practice faculty and students provide compassionate research-based nursing care. Through such work, Duke faculty, students, and graduates are shaping the future of professional nursing practice.

### **Programs**

#### **THE MASTER OF SCIENCE IN NURSING PROGRAM**

The School of Nursing offers a flexible, 39- to 43-credit program leading to the Master of Science in Nursing degree. Graduates are prepared as clinical nurse specialists in critical care, gerontology, oncology or pediatrics; as adult nurse practitioners (with specialization in management of acute and chronic illness or oncology), as gerontological nurse practitioners, family nurse practitioners, or pediatric nurse practitioners; and as mid-level nurse administrators. Students pursue their educational endeavors with faculty and clinical/consulting associates who have expertise and research in the student's chosen area of specialization. The curriculum is designed to provide maximum flexibility for full-time or part-time study.

The integration of education, practice and research undergirds the entire curriculum and the behavior of those individuals involved in the educative process. Upon completion of the program, the graduate will be able to:

1. synthesize concepts and theories from nursing and related disciplines to form the basis for advanced practice,
2. demonstrate expertise in a defined area of advanced practice,
3. utilize the process of scientific inquiry to validate and refine knowledge relevant to nursing,
4. demonstrate leadership and management strategies for advanced practice,
5. demonstrate proficiency in the use and management of advanced technology related to patient care and support systems,

6. analyze socio-cultural, ethical, economic, and political issues that influence patient outcomes, and
7. demonstrate the ability to engage in collegial intra- and inter-disciplinary relationships in the conduct of advanced practice.

A student may choose to major in one of the following areas: 1. administration of nursing systems; 2. adult nurse practitioner (with an acute and chronic illness or oncology focus); 3. critical care (clinical nurse specialist); 4. oncology (clinical nurse specialist); 5. gerontology (nurse practitioner or clinical nurse specialist); 6. pediatrics (nurse practitioner or clinical nurse specialist); and 7. family nurse practitioners.

## THE POST-MASTER'S CERTIFICATE PROGRAM

The School of Nursing offers a post-master's certificate to students who already have an earned MSN and are seeking specialized knowledge within a major offered in the school's master's program. The number of credits required to complete the certificate program varies by major; the student must successfully complete the required courses in the chosen nursing major. Completion of the certificate program will be documented in the student's academic transcript. Depending upon the major, the student may then meet the qualifications for advanced practice certification in the specialty area. For example, students who complete the post-master's certificate in the nurse practitioner majors are eligible to sit for certification examinations.

## Admission and Progression

### ADMISSION REQUIREMENTS FOR THE MASTER'S DEGREE

1. Bachelor's degree with an upper division nursing major from a program accredited by the National League for Nursing. The bachelor's or post-bachelor's course work must include satisfactory completion of a course in descriptive and inferential statistics.
2. Minimum of one year's experience in an area relevant to the projected course of study for all specialties.
3. Undergraduate grade point average of 3.0 on a 4.0 scale.
4. Satisfactory performance on the Graduate Record Examination (GRE) or Miller Analogies Test (MAT).
5. Eligibility to be licensed as a professional nurse in North Carolina.\*
6. Documentation of the acquisition of physical assessment knowledge and skills, for those applicants choosing a clinical specialty.
7. Three references attesting to personal and professional qualifications. At least two references must be from former employers, faculty members, or deans.

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\* Candidates for admission to the Duke University School of Nursing must obtain a license to practice in the state of North Carolina before matriculation. Offers of admission to the School of Nursing cannot be considered final until matriculants present proof of licensure to the Office of Admissions no later than the end of the first day of class during the semester of matriculation.

Students enrolled in the Graduate School of Nursing must maintain a current North Carolina license and are required to show proof of licensure, or status of renewal of license, to the admissions officer on a yearly basis (January).

Information on licensure procedures for the state of North Carolina may be obtained from the North Carolina Board of Nursing, P.O. Box 2129, Raleigh, North Carolina 27602, or by calling 919-782-3211 or 919-733-5356.



8. Personal interview. Other arrangements may be considered when distance is a factor.

Selection will be based on the applicant's qualifications, intellectual curiosity, potential for professional growth, and contributions to the profession. Exception to any of the admission requirements will be considered on an individual basis.

#### **ADMISSION REQUIREMENTS FOR THE POST-MASTER'S CERTIFICATE OPTION**

1. Completion of application for certificate program including undergraduate and graduate transcripts. The bachelor's or post-bachelor's course work must include satisfactory completion of a course in descriptive and inferential statistics.
2. Minimum of one year's experience in an area relevant to the projected course of study for all specialties.
3. A master's degree from an NLN accredited school of nursing.
4. Licensure or eligibility for licensure as a registered nurse in North Carolina.
5. Documentation of the acquisition of physical assessment knowledge and skills, for those applicants choosing a clinical specialty.
6. Two letters of academic and/or professional reference.
7. Interview with a faculty member in the specialty area.

#### **ADDITIONAL ADMISSION REQUIREMENTS FOR INTERNATIONAL APPLICANTS**

International students provide a unique cultural and personal addition to Duke. They are encouraged to apply early in the academic year prior to the year they wish to attend Duke to ensure time to complete the following additional requirements:

1. evidence of adequate financial support for the duration of the program;
2. a minimum score of 550 on the Test of English as a Foreign Language (TOEFL) if English is not the primary language;
3. a passing score on the Commission on Graduates of Foreign Nursing Schools (CGFNS) examination.

The Commission on Graduates of Foreign Nursing Schools (CGFNS) examination is a prerequisite for taking the Registered Nurse Licensing examination in the state of North Carolina and for obtaining a nonimmigrant occupational preference visa (H1-A) from the United States Immigration and Naturalization Service. CGFNS offers a two-part certification program that includes a credentials review, followed by a test of nursing and English language skills. The CGFNS examination is given in March, August, and November. Application materials may be requested from CGFNS, 3624 Market Street, Philadelphia, Pennsylvania 19014 (215-349-8767). For further information, contact the School of Nursing admissions officer.

#### **ADMISSION PROCEDURE**

An applicant to the Duke University School of Nursing Graduate Program must obtain an application form from the School of Nursing admissions office. A check or money order for the nonrefundable processing fee of \$50 must accompany each application. In addition, the applicant should provide the following supporting documents:

1. two copies of the official transcript from each college or university attended, to be sent directly to the admissions office of the School of Nursing;
2. two supplementary transcripts showing completion of work that was in progress when the earlier transcripts were obtained, if necessary;
3. three letters of recommendation (*on forms provided by the School of Nursing*) by persons qualified to judge the applicant as a prospective graduate student, to

be mailed directly to the admissions office (at least two must be from current or former employers, faculty members, or deans); and,

4. for master's degree applicants, scores from the Graduate Record Examination (GRE) or Miller Analogies Test (MAT) that are not more than five years old.

Testing dates and locations for the Graduate Record Examination can be obtained from most colleges or from the Educational Testing Service, P. O. Box 6000, Princeton, New Jersey 08541-6000 (609-771-7670 or 510-654-1200). Information for the Miller Analogies Test (MAT) (1-800-622-3231) can be obtained from the Psychological Corporation, 555 Academic Court, San Antonio, Texas 78204-3956 (210-921-8801). Information also may be obtained from Duke University's Office of Counseling and Psychological Services (CAPS) (919-660-1000). The number to use on the GRE to indicate that you want a copy of your scores sent to the School of Nursing is R5173. The number to use on the MAT is 2734.

Once all of the above information is received by the admissions office, a faculty member will contact the applicant and arrange a personal interview.

## CONSIDERATION OF APPLICATION

The application will be considered when all forms have been received by the School of Nursing Office of Admissions. Complete applications to the Duke University School of Nursing Graduate Program must be submitted by the following dates:

March 1 (for regular admission fall semester);

March 1 (summer term) or November 1 (spring semester).

It is the responsibility of the applicant to ensure that the admissions office of the School of Nursing receives all required materials before the deadline.

**Notification of Status.** Admission may be approved, deferred, or rejected. If admission is approved, the applicant will receive a letter of admission and acceptance forms. The process of admission is not complete until the acceptance forms and nonrefundable tuition deposit of \$100 have been received by the admissions office of the School of Nursing. This fee will be credited toward tuition. Once the acceptance forms and tuition-deposit fee have been received, applicants needing financial assistance will be contacted by letter by the financial aid officer of the School of Nursing concerning their eligibility for financial aid. However, students are highly encouraged to complete and submit a free Application for Federal Student Aid as soon as possible *before* applying for admission. Applicants whose admission is deferred or rejected will be notified by letter.

**Health and Immunization Record.** North Carolina law requires all new students to present proof of certain immunizations before matriculation. The Duke University Student Health Immunization Form and Report of Medical History, furnished by Duke University, should be completed and returned to the Director of Student Health Services, Box 2899 DUMC, Duke University, Durham, North Carolina 27710 (919-684-3367).

It is preferable for students to arrive on campus with complete, verified immunization forms. For those who are unable to do so, the Durham County Health Department (560-7600) on Main Street provides some of the necessary inoculations free of charge. On-campus inoculations are available through Student Health Services (684-3367). A special immunization clinic is held during the days when new students arrive on campus, with a nominal charge for on-campus immunizations. Failure to comply with health and immunization requirements will delay registration for class and/or final acceptance into School of Nursing programs.

## FULL-TIME AND PART-TIME DEGREE STATUS

Opportunities for part-time and full-time study are available. Full-time status is defined as taking a minimum of nine (9) credits per semester, excluding summer session when fewer credits may be taken. Students who wish to change from full-time or part-time status must request permission from the dean.

## **NONDEGREE STUDENTS**

Individuals may take graduate level courses as a nondegree student, provided they have a bachelor of science in nursing degree from a National League for Nursing accredited school. Nondegree students are admitted to individual classes by permission of the instructor on a space available basis. To apply, an official copy of all undergraduate nursing transcripts must be sent to the School of Nursing Office of Admissions along with a completed Application for Admission as a Nondegree Student and a \$50 application fee. Students who register for clinical courses also must submit two letters of reference from their employer and evidence of licensure as a nurse in the state of North Carolina.

All nondegree application requirements must be received by July 1 for fall courses, November 1 for spring courses, and March 1 for summer courses. Requests for nondegree status will be considered within two weeks after the appropriate deadline. If permission is granted by the faculty, the student will be notified by the Office of Admissions. (Nondegree students requesting a second course make the request to the Office of Admissions of the School of Nursing.) Up to seven credits earned as a nondegree student are accepted for credit towards the MSN degree if the applicant is later admitted to the master's program. Permission to take course work as a nondegree student does not guarantee admission to the School of Nursing.

## **TRANSFER OF GRADUATE CREDITS**

A maximum of six units of graduate credit may be transferred for graduate courses completed at other accredited institutions (or in other graduate programs at Duke). Transfer credit will be given only for academic work completed within five years before matriculation at Duke. Such units are transferable only if the student has received a grade of *B* (3.0 or its equivalent) and after the student has earned a minimum of 6 units of graduate credit at Duke University School of Nursing. A student wishing to transfer course work should make a written request, and provide a syllabus or some other description of the course to his/her academic advisor.

## **TRANSFER TO ANOTHER GRADUATE NURSING MAJOR**

A change of graduate nursing major may be made, contingent upon approval of the faculty involved. Should a change be made, a student must meet all requirements of the new major.

## **TIME FOR COMPLETION OF THE MASTER'S DEGREE**

The master's degree student should complete all requirements for the degree within five calendar years from the date of initial matriculation. No full-time residence is required; however, all students enrolled in the school who have not been granted a leave of absence by the dean must register each fall, spring, and summer until all degree requirements are completed.

## **ADVISEMENT**

An interim academic advisor for each student is assigned on admission to the program. After consultation with the interim and proposed advisors, students select their permanent advisor according to their clinical and research interests in the area of study. This advisor assists the student in planning and implementing his/her course of study throughout the master's program.

## **GRADES**

For credits earned toward completion of the thesis, N313, or non-thesis project, N314, residencies (cf. courses of instruction for course numbers), independent studies (N399), and elective courses (if offered with credit/no-credit option), the professor will assign a designation of "Cr." This designation indicates that the student has successfully completed all of the requirements for those credits registered. A minimum of six credits



must be earned for N313 or N314; however, these credits may be earned in any amount of whole number increments to total six.

A cumulative GPA of 3.0 or above in the master's program is required at the completion of seven credits. Students with a GPA between 2.0 and 2.99 at the completion of seven credits will be placed on academic probation. The student will then be required to meet with the academic advisor to plan an appropriate course of study. Students who do not have a cumulative GPA of 3.0 at the completion of twelve credits will be asked to withdraw from the program. Graduate students are required to maintain a cumulative GPA of 3.0 or above for graduation. No more than six credits of graduate credit with a grade of C (includes C- and C+) will be applied toward graduation requirements.

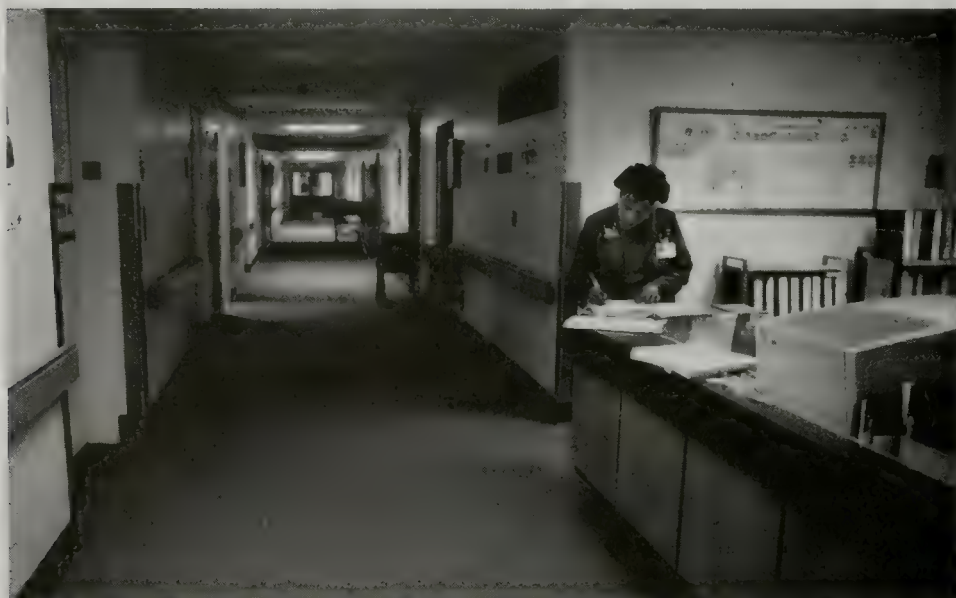
### **WITHDRAWAL FROM A COURSE**

Students may make changes in their schedule during the two week drop/add period at the beginning of the fall and spring semesters and during the first three days of the summer semester. A fee is charged by the university if changes are made after that period. The signatures of the advisor and the dean are necessary to drop or add courses. If a course is dropped after the drop-add period, the status of the student at the time of withdrawal from the course will be indicated on the record as *Withdrew Passing* (WP) or *Withdrew Failing* (WF).

### **INTERRUPTION OF PROGRAM AND WITHDRAWAL FROM THE GRADUATE PROGRAM**

The School of Nursing reserves the right, and matriculation by the student is a concession of this right, to request the withdrawal of any student whose performance at any time is not satisfactory to the School of Nursing. If a student for any reason wishes to withdraw from the school, notification should be made to the dean before the expected date of withdrawal. Students who have withdrawn from the program must apply for readmission according to regular admission policies.

Students who find it necessary to interrupt their program of study should request in writing a leave of absence addressed to the dean of the School of Nursing. A maximum of one calendar year's leave may be granted; this will be counted toward the total time allowed to complete the program.



## COMMENCEMENT

Graduation exercises are held once a year, in May, when degrees are conferred and diplomas issued to students who have completed all requirements. Students who complete degree requirements by the end of the fall or by the end of the summer term receive diplomas dated December 30 or September 1, respectively. There is a delay in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and Board of Trustees. All graduates, including those receiving degrees in December and September, are expected to attend graduation exercises in May.

## Requirements for the Master's Degree

Each of the school's majors requires the completion of 39 or 43 units of credit. These units include core courses required of all master's students, the research option (either the thesis, a research project, or a course in research utilization), courses in the major, and electives. Each major requires the student to complete a clinical residency.

Required Core Courses*	Credits
N301. Foundations of Advanced Nursing Practice	3
N302. Informatics	2
N303. Issues in Contemporary Health Care Organizations	3
N307. Research Methods	2
N308. Applied Statistics	2
Total	<u>12</u>
Research Options (Select One)*	Credits
N312. Research Utilization	3
N313. Thesis	6
N314. Nonthesis Research Project	6
Total	<u>3-6</u>

## Major Fields of Study

### ADMINISTRATION OF NURSING SYSTEMS

The major in Administration of Nursing Systems focuses on changes in the health care delivery system, models of nursing care delivery, financial management and patient outcomes. The total minimum number of credits required for graduation is 39. Course work in the major includes the following:

	Credits
N340. Administration of Nursing Systems I	3
N344. Administration of Nursing Systems II	3
N348. Budget Planning and Financial Management	3
N345. Nursing Administration Residency	3-9
Electives/Independent Study	3-12
Total	<u>21-24</u>

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\*Required of all MSN candidates.

## NURSE PRACTITIONER MAJORS

The nurse practitioner majors focus on the knowledge and skills necessary to provide primary care across settings, including care of individuals in rural and underserved areas. The total minimum number of credits required for graduation is 42. Course work in the major includes 18 credit units of practitioner core courses and 9 additional credits including the residency in the major.

<b>Practitioner Core Courses (Required for all NP students)</b>	<b>Credits</b>
N352. Diagnostic Reasoning and Physical Assessment	4
N353. Theoretical Bases for Management of Care	3
N354. Managing Common Acute and Chronic Health Problems I	4
N355. Managing Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
Total	18

## NURSE PRACTITIONER OPTIONS

<b>Adult Nurse Practitioner–Acute and Chronic Illness Management Major</b>	<b>Credits</b>
N321. Foundations of Advanced Acute/Critical Care Nursing Practice I	3
N323. Foundations of Advanced Acute/Critical Care Nursing Practice II	3
N326. Nurse Practitioner Residency: Acute and Chronic Illness Management	3
Total	9

<b>Adult Nurse Practitioner–Oncology Major</b>	<b>Credits</b>
N330. Oncology Nursing I: Epidemiology and Pathophysiology	3
N332. Oncology Nursing II: Symptom and Problem Management	3
N335. Nurse Practitioner Residency: Oncology	3
Total	9

<b>Gerontological Nurse Practitioner</b>	<b>Credits</b>
N370. Social Issues, Health, and Illness in the Aged Years	3
N376. Managing Care of the Frail Elderly	3
N375. Nurse Practitioner Residency: Gerontology	3
Total	9

<b>Pediatric Nurse Practitioner</b>	<b>Credits</b>
N384. Advanced Concepts in Development in Pediatric Nursing Practice	3
N385. Advanced Nursing Care of Children with Major Illnesses	3
N386. Nurse Practitioner Residency: Pediatrics	3
Total	9

<b>Family Nurse Practitioner Major</b>	<b>Credits</b>
N393. Managing Common Acute and Chronic Health Problems III	3
N394. Managing Common Acute and Chronic Health Problems IV	3
N395. Family Nurse Practitioner Residency	4
Total	10



## CLINICAL NURSE SPECIALIST MAJORS

The clinical nurse specialist majors focus on the knowledge and skills necessary to provide care to patients with complex health problems and their families, in a variety of settings. The total minimum number of credits required for graduation is 39. Course work in the majors includes 10 credit units in the clinical nurse specialist core courses and 9 to 14 credit units in the major. Elective credits are used to support the major.

### Clinical Nurse Specialist Core Courses (Required for all CNS students)

	Credits
N352. Diagnostic Reasoning and Physical Assessment	4
N353. Theoretical Bases for Management of Care	3
N356. Clinical Pharmacology and Interventions	3
Total	10

## CLINICAL NURSE SPECIALIST OPTIONS

### CNS—Critical Care Major

	Credits
N321. Foundations of Advanced Acute/Critical Care Nursing Practice I	3
N323. Foundations of Advanced Acute/Critical Care Nursing Practice II	3
N325. CNS Practicum—Acute/Critical Care Nursing	3
Electives/Independent Study	2-5
Total	11-14

### CNS—Gerontology Major

	Credits
N370. Social Issues, Health, and Illness in the Aged Years	3
N354. Managing Common Acute and Chronic Health Problems I	4
N355. Managing Common Acute and Chronic Health Problems II	4
N376. Managing Care of the Frail Elderly	3
Total	14

### CNS—Oncology Major

	Credits
N330. Oncology Nursing I: Epidemiology and Pathophysiology	3
N332. Oncology Nursing II: Symptom and Problem Management	3
N334. Clinical Nurse Specialist Residency: Oncology	3
Electives/Independent Study	2-5
Total	11-14

### CNS—Pediatrics Major

	Credits
N384. Advanced Concepts in Development in Pediatric Nursing Practice	3
N385. Advanced Nursing Care of Children with Major Illnesses	3
N383. CNS Practicum: Pediatrics	3
Electives/Independent Study	2-5
Total	11-14

## Course of Study for the Post-Master's Certificate

The purpose of the post-master's certificate program is to provide opportunities for students who already have an earned MSN to gain specialized knowledge within a major provided at Duke University School of Nursing. The post-MSN certificate repre-

sents the student's successful completion of the required courses in the chosen nursing major. Course requirements for the post-MSN certificate are listed below by major.

## NURSING ADMINISTRATION

	Credits
N340. Administration of Nursing Systems I	3
N344. Administration of Nursing Systems II	3
N345. Nursing Administration Residency	3-9
N348. Financial Planning and Budget Analysis	3
Total	12-18

## ACUTE/CRITICAL AND CHRONIC ILLNESS MANAGEMENT

Clinical Nurse Specialist	Credits
N321. Foundations of Acute/Critical Care Nursing I	3
N323. Foundations of Acute/Critical Care Nursing II	3
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N356. Clinical Pharmacology and Interventions	3
N325. CNS Practicum: Acute/Critical Care	3
Total	19

Nurse Practitioner	Credits
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Common Acute and Chronic Health Problems I	4
N355. Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N326. NP Residency: Acute and Chronic Illness Management	3
Total	21
N321. Foundations of Advanced Acute/Critical Care Nursing Practice I	3
N323. Foundations of Advanced Acute/Critical Care Nursing Practice II	3
Total	27*

## GERONTOLOGICAL NURSING

Clinical Nurse Specialist	Credits
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Common Acute and Chronic Health Problems I	4
N355. Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N370. Social Issues, Health and Illness in the Aged Years	3
N376. Managing Care of the Frail Elderly	3
N3xx. Health Care Needs and Delivery of Care to Underserved Populations ( <i>Optional</i> )	3
Total	24 (27)

\*If a candidate has an MSN with a clinical major but desires the NP post-master's certificate in a different area, or if the candidate has an MSN in administration, the two clinical courses (6 credits) in the new area will also be required.

<b>Nurse Practitioner</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Common Acute and Chronic Health Problems I	4
N355. Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N370. Social Issues, Health and Illness in the Aged Years	3
N376. Managing Care of the Frail Elderly	3
N3xx. Health Care Needs and Delivery of Care to Underserved Populations ( <i>Optional</i> )	3
N375. GNP Clinical Residency	3
<b>Total</b>	<b>27 (30)</b>

## **ONCOLOGY NURSING**

<b>Clinical Nurse Specialist</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N356. Clinical Pharmacology and Interventions	3
N330. Oncology Nursing I: Epidemiology and Pathophysiology	3
N332. Oncology Nursing II: Symptom and Problem Management	3
N334. Clinical Nurse Specialist Residency: Oncology	3
<b>Total</b>	<b>19</b>

<b>Nurse Practitioner</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Common Acute and Chronic Health Problems I	4
N355. Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N335. Nurse Practitioner Residency: Oncology	3
<b>Total</b>	<b>21</b>
N330. Oncology Nursing I: Epidemiology and Pathophysiology	3
N332. Oncology Nursing II: Symptom and Problem Management	3
<b>Total</b>	<b>27*</b>

## **PEDIATRIC NURSING**

<b>Clinical Nurse Specialist</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N356. Clinical Pharmacology and Interventions	3
N384. Advanced Concepts in Development in Pediatric Nursing Practice	3
N385. Advanced Nursing Care of Children with Major Illnesses	3
N383. CNS Practicum: Pediatrics	3
<b>Total</b>	<b>19</b>

\*If a candidate has an MSN with a clinical major but desires the NP post-master's certificate in a *different* area, or if the candidate has an MSN in administration, the two clinical courses (6 credits) in the new area will also be required.



<b>Nurse Practitioner</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Common Acute and Chronic Health Problems I	4
N355. Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N386. Nurse Practitioner Residency: Pediatrics	3
Total	<u>21</u>

N384. Advanced Concepts in Development in Pediatric Nursing Practice	3
N385. Advanced Nursing Care of Children with Major Illnesses	3
Total	<u>27*</u>

<b>Family Nurse Practitioner</b>	<b>Credits</b>
N352. Physical Assessment and Diagnostic Reasoning	4
N353. Theoretical Bases for Management of Care	3
N354. Managing Common Acute and Chronic Health Problems I	4
N355. Managing Common Acute and Chronic Health Problems II	4
N356. Clinical Pharmacology and Interventions	3
N393. Managing Common Acute and Chronic Health Problems III	3
N394. Managing Common Acute and Chronic Health Problems IV	3
N395. Family Nurse Practitioner Residency	4
Total	<u>28</u>



## Courses of Instruction\*

**301. Theoretical Foundations of Advanced Nursing Practice.** This course is designed to explore the theoretical bases for development of the advanced practice nurse and advanced practice. The focus will be the application of theoretical and conceptual frameworks to guide decision making for culturally diverse populations with a variety of problems to achieve desired outcomes. A variety of developmental, systems, psychodynamic, physiological, and nursing theories and conceptualizations relevant to health and illness care will be presented. Fall. 3 units. *Brundage and McIntire*

**302. Nursing Informatics.** An introduction to computer technology in the health care arena with a focus on selected computer applications commonly used in the management of health care information. The automation of data management and its impact on nursing administration, education, practice and research are addressed in the context of information systems and nursing informatics. Fall, spring. 2 units. *Hewitt*

**303. Issues in Contemporary Health Care Organizations.** Survey of key concepts that form the bases for understanding health care institutions and the environment in which they exist. Current issues affecting health care institutions within the context of the financial and political systems will be analyzed in relation to their impact on advanced nursing practice. Steps to prepare the advanced practice nurse to negotiate an independent contract will be introduced. Fall, spring. 3 units. *Staff*

**307. Research Methods.** Focuses on research methods needed for systematic investigation and expansion of nursing knowledge. How to critically read research and develop a research proposal also will be studied. Fall, spring. 2 units. *Champagne and Turner*

**308. Applied Statistics.** Emphasizes the application and interpretation of statistical procedures used in health care and nursing research. Data management and the relationship between research design and statistical techniques also will be studied. Spring. Prerequisite: Nursing 307 or consent of instructor. 2 units. *Champagne*

**312. Research Utilization in Advanced Nursing Practice.** The focus of this course is upon methods of implementing research findings to solve identified clinical problems. Students will obtain skill in developing research-based protocols and in using research methods to evaluate nursing care. Spring, summer. Prerequisites: Nursing 307 and 308, or consent of instructor. 3 units. *Champagne and Hawthorne*

**313. Thesis.** 1 to 6 units. Fall, spring, summer. Variable credit. *Staff*

**314. Non-Thesis Option.** 1 to 6 units. Fall, spring, summer. Variable credit. *Staff*

**316. Scientific Writing.** This course provides a review of the principles and practice of scientific writing, with emphasis on research proposals, theses, other scientific papers, and articles for publication. Students are expected to complete a proposal for a thesis or a non-thesis option, an article, or other scientific work as part of the course. Fall, summer. 3 units. *Tornquist*

**321. Foundations of Advanced Acute/Critical Care Nursing Practice I.** Provides information underpinning patient responses to common critical illnesses approached through an integration of physiological, family, and organizational systems theory. Course content includes pathophysiologic concepts and theory necessary for skilled

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\*Course offerings and content subject to change.

advanced nursing practice (assessing, monitoring, selecting, teaching, and coaching) for patients and their families in acute and/or critical care settings. This course focuses on patients with cardiopulmonary, hemodynamic, and electrolyte problems. Spring. Prerequisite: Nursing 352. 3 units. *Hawthorne*

**323. Foundations of Advanced Acute/Critical Care Nursing Practice II.** Provides information underpinning patient responses to common critical illnesses approached through an integration of physiological, family, and organizational systems theory. Course content includes pathophysiologic concepts and theory necessary for skilled advanced nursing practice (assessing, monitoring, selecting, teaching, and coaching) for patients and their families in acute and/or critical care settings. This course focuses on patients with neurological, renal, hepatic, and gastrointestinal problems and also trauma, multi-organ system failure, and immunosuppression. Summer. Prerequisites: Nursing 321 and 352. 3 units. *Brundage*

**325. Clinical Nurse Specialist Practicum: Acute/Critical Care Nursing.** Provides the student with supervised practice as a clinical nurse specialist. Emphasis is upon the development of the domains and competencies of clinical nurse specialty practice within acute care settings. Students specialize in nursing care of selected patient populations. Fall, spring, summer. Prerequisites: Nursing 321, 323, 352, 353, and 356. 3 units. *Brundage, Hawthorne, and Hickey*

**326. Nurse Practitioner Residency: Acute and Chronic Illness Management.** Provides the student with supervised practice as a nurse practitioner. Emphasis is upon the development of the domains and competencies of nurse practitioner practice in both acute and primary care settings. Activities also emphasize the management of major acute and chronic illnesses. Fall, spring, summer. Prerequisites: Nursing 321, 323, 352, 353, 354, 355, and 356. 3 units. *Brundage, Hawthorne, and Hickey*

**330. Oncology Nursing I: Epidemiology and Pathophysiology.** Focus is on the epidemiology, pathophysiology, and biobehavioral aspects of cancer across the adult years. Major topics include cancer physiology, prevention, detection, role of defenses, treatment, and responses to cancer. Spring, summer. 3 units. *McIntire*

**332. Oncology Nursing II: Symptom and Problem Management.** The ONS Guidelines for Oncology Nursing Practice serve as the framework for examination of potential problems and symptom management in cancer patients. Topics include knowledge deficit, information, coping, comfort, nutrition, protective mechanisms, mobility, elimination, sexuality, ventilation, circulation, and managed care. Case management and case studies are used in seminars. Fall, summer. Prerequisite: Nursing 330. 3 units. *McIntire*

**334. Clinical Nurse Specialist Residency: Oncology.** A clinical practicum in which students specialize in their interest areas, choosing among ambulatory/clinic care, inpatient care, bone marrow transplant care, community/preventive care, home care, hospice care, and care of persons with HIV and AIDS. Case management, care maps, case studies, and ONS Guidelines for Oncology Nursing Practice serve as formats for the practicum and seminars. Fall, spring, summer. Prerequisites: Nursing 330, 332, 352, 353, and 356. 3 units. *McIntire*

**335. Nurse Practitioner Residency: Oncology.** A clinical residency in which students specialize in the domains and competencies of the adult practitioner in oncology nursing. The areas include managing patient illness in ambulatory and acute inpatient settings, monitoring quality care, organizational and role competencies, healing and teaching roles. Fall, spring, summer. Prerequisites: Nursing 330, 332, 352, 353, 354, 355, and 356. 3 units. *McIntire*

**340. Administration of Nursing Systems I.** Focuses on the theoretical bases for developing and maintaining nursing systems in health care/health related institutions.



Development of management skill serves as the basis for further inquiry and development of the nurse administrator role. Problem solving methodology is used to develop strategies for dealing with issues from the internal and external environment of health care institutions. Fall. 3 units. *Havens*

**344. Administration of Nursing Systems II.** Focuses on the theoretical bases of leadership in facilitating the development of professional nursing practice. Development, maintenance, and supervision of nursing systems in health care/health related institutions are discussed. Regulation and legal tenets from the external environment and their impact on the administration of nursing systems are emphasized. Spring. Prerequisite: Nursing 340. 3 units. *Staff*

**345. Nursing Administration Residency.** The residency builds upon student's prior knowledge and experience in nursing administration. The intent is to develop independent problem solving skills while under the guidance and mentorship of a practicing nurse administrator. The minimum required credits are three with a maximum of nine credits for those needing additional learning experiences with a preceptor. 3 to 9 units. Summer. Prerequisites: Nursing 340 and 344. Variable credit. *Havens*

**348. Budget Planning and Financial Management.** Designed for managers in complex organizations. Focuses on the knowledge and skills needed by the nurse manager to plan, monitor, and evaluate budget and fiscal affairs for a defined unit or clinical division. Health care economics, personnel, and patient activities are analyzed from a budgetary and financial management perspective within an environment of regulations and market competition. Spring. Prerequisite: Nursing 303 suggested. 3 units. *Staff*

**352. Diagnostic Reasoning and Physical Assessment in Advanced Nursing Practice.** Combines lecture and laboratory experiences to develop advanced skills in assessment of physical, cognitive, nutritional and functional domains. Nurse-patient interaction, data collection, and diagnostic reasoning are emphasized. Consent of instructor required. Fall, spring. 4 units. *Friedman, Greene, Hawthorne, Lorimer, Ouimette, and Wilkman*

**353. Theoretical Bases for Management of Care in Advanced Nursing Practice.** The course is designed to give the student a broad view of models for holistic management of care across settings and illness trajectories and to analyze the role of the advanced practice nurse in providing care to culturally diverse patients and families. Collaboration, coordination for continuity of care, and innovation to address cost, quality, and access are stressed. Models for monitoring and evaluating total quality assurance and standards of practice are developed to insure cost-effective and quality care that matches patient needs. Summer. 3 units. *Hickey*

**354. Managing Common Acute and Chronic Health Problems I.** The course emphasizes assisting patients to reach or maintain their highest level of health and functioning. The focus will be on health promotion, health maintenance, and primary care management of respiratory, cardiac, gastrointestinal, and mental health problems encountered by patients and their families. The pharmacological management of common problems is systematically integrated into the course. Clinical practicums are in a variety of settings. Practice settings include rural health clinics, home, hospital units, and long-term care facilities. Advanced practice role development is incorporated into the course through care management seminars and supervised clinical practice. Spring. Prerequisites: Nursing 352; prerequisite/concurrent: Nursing 356. 4 units. *Friedman, Greene, Hawthorne, Lorimer, Ouimette, and Wilkman*

**355. Managing Common Acute and Chronic Health Problems II.** The course emphasizes assisting patients to reach or maintain their highest level of health and

functioning. The focus will be on health promotion, health maintenance, and primary care management of common skin disorders, arthritic, neurologic, gynecologic, anemia, and endocrine problems encountered by patients and their families. The pharmacological management of common problems is systematically integrated into the course. Clinical practicums are in a variety of settings. Practice settings include rural health clinics, home, hospital units, and long-term care facilities. Advanced practice role development is incorporated into the course through care management seminars and supervised clinical practice. Summer. Prerequisites: Nursing 352 and 356. 4 units. *Friedman, Greene, Hawthorne, Lorimer, Ouimette, and Wilkman*

**356. Clinical Pharmacology and Interventions for Advanced Nursing Practice.** The course is a combination of lecture and case analyses designed to increase assessment and management skills related to pharmacological management of patients with a variety of common acute and chronic health problems. Data collection and diagnostic reasoning are emphasized in relation to drug selection, patient/family education, monitoring, and evaluation of pharmacological interventions. Spring. 3 units. *Brundage and Kessler*

**360. Concepts of Teaching and Learning.** Focuses on the key concepts and principles that form the bases for the teaching and learning process. Educational theories of teaching and learning, situations and issues serve as the framework for developing instructional strategies used in advanced nursing practice roles. Spring or summer. 3 units. *McIntire*

**362. Ethics in Nursing.** Focuses on the historical development of ethics in nursing, analysis of moral language, codes of ethics, frameworks for ethical decision making with case analysis, and strategies for discussion of ethics in nursing. Spring or summer. 3 units. *Staff*

**370. Social Issues, Health, and Illness in the Aged Years.** Examines diversity in development and adaptation to environmental, social, psychological, and biological changes. Theories of aging, health and aging, intimacy and sexuality, rural-urban health care patterns, minority health care patterns, demographic trends, and death, dying, and loss are discussed. Spring. 3 units. *Wallsten*

**375. Nurse Practitioner Residency: Gerontology.** The residency provides GNP students with concentrated clinical opportunities. Emphasis is on clinical decision making, practice issues, and organizational management. Residency sites and associated preceptors are arranged by faculty. Fall, spring, summer. Prerequisites: Nursing 352, 353, 354, 355, 356, 370, and 376. 3 units. *Ouimette and Wallsten*

**376. Managing Care of the Frail Elderly.** Emphasizes assessment, rehabilitation, and management of complex problems of elders who reside in community and institutional settings. Research projects and innovative care strategies are explored. Organizational and managerial effectiveness and consultative roles of the GNP/GCNS are examined. Fall. Prerequisites: Nursing 352, 353, 354, 355, and 356. 3 units. *Ouimette and Wallsten*

**383. Clinical Nurse Specialist Practicum: Pediatrics.** Supervised clinical practicum exploring the role of the clinical nurse specialist in a pediatric setting of the student's choice. Fall, spring, summer. Prerequisites: Nursing 352, 353, 356, 384, and 385. 3 units. *Oehler*

**384. Advanced Concepts in Development in Pediatric Nursing Practice.** Focuses on the importance of developmental issues in the advanced practice of pediatric nursing. Normal cognitive, motoric, social/emotional, and language development and the usual developmental challenges of each age group are addressed in the context of health

maintenance and management of illness. Spring. Prerequisite: Nursing 352. 3 units. *Oehler*

**385. Advanced Nursing Care of Children.** This course addresses societal and family issues that impact on the maintenance of health in children and complex care management by the advanced pediatric nurse practitioner. Summer. Prerequisites: Nursing 352 and 384. 3 units. *Oehler*

**386. Nurse Practitioner Residency: Pediatrics.** Supervised clinical practice in an approved setting which allows the opportunity for practice as a pediatric nurse practitioner. Fall, spring, summer. Prerequisites: Nursing 352, 353, 354, 355, 356, 384, and 385. 3 units. *Lorimer and Oehler*

**393. Family Nurse Practitioner in Rural and Underserved Areas: I.** This course bases all learning on a health promotion/illness prevention framework for the family through the life span living in rural and underserved areas with special focus on teaching/counseling families; normal growth and development of families from newborn to the older adult; nutrition; and identifying the special needs of the family living in areas with limited access to health care. Fall. Prerequisites: Nursing 352, 353, 354, 355, and 356. 3 units. *Friedman and Greene.*

**394. Family Nurse Practitioner in Rural and Underserved Areas: II.** This course integrates earlier course work on acute and chronic illness and applies this knowledge to the family experiencing short-term disruptions in health or long-term chronic illness. Clinical application includes management with families along the life span including common illnesses of children, self-limiting problems of the adult and older adult population, and illnesses that are chronic in nature. Students will work collaboratively with health care professionals to intervene and manage women having high-risk pregnancies. Spring. Prerequisites: Nursing 352, 353, 354, 355, 356, and 393. 3 units. *Friedman and Greene*

**395. Family Nurse Practitioner Residency in a Rural or Medically Underserved Area.** This residency occurs in a clinical setting with the student having the mentorship of either a nurse practitioner or primary care physician. Seminars are conducted to allow the student to synthesize learning from clinical applications of advanced practice. The student is expected to perform health assessments, order and interpret diagnostic tests, determine a plan of care for family members, collaborate with the health team, and refer patients to other health care providers when appropriate. Fall, spring, summer. Prerequisites: Nursing 352, 353, 354, 355, 356, 393, and 394. 4 units. *Friedman and Greene.*

**399. Selected Topics or Independent Study.** Students select a topic of professional interest within the specialty area or in support of the specialty area, to be studied with a faculty member. Specific objectives, evaluation method, and other requirements are determined prior to registering for the course of study. Consent of instructor required. 1 to 3 units. Fall, spring, summer. Prerequisite: matriculation into Nursing Curriculum. Variable credit. *Staff*



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## *The Allied Health Programs*



## **The Allied Health Programs**

There are several health-service related educational programs offered through the Division of Allied Health of the Duke University Medical Center that are neither medicine nor nursing. Currently, the Allied Health Division is comprised of four master's degree programs and several certificate programs. Every effort is made to keep each of these Allied Health programs closely related to the Medical School departments whose fields they serve. Today, there are approximately 269 students enrolled in such programs at Duke University. In addition, the School of Medicine is affiliated with one master's level program that is administered through the Graduate School.

## **Resources for Study**

All of the study facilities available to medical students are available to allied health students. See descriptions for Library/Communications Center, the Thomas D. Kinney Central Teaching Laboratory and Division of Audiovisual Education which may be found in a foregoing portion of this bulletin.

Several of the allied health programs have affiliations with other hospitals and medical institutions for clinical instruction.

## **Student Life**

**Living Accommodations.** Because of the shortage of residential space, students enrolled in allied health certificate programs are not eligible for student housing. Student's enrolled in the Master's Programs, however, are eligible. The Department of Housing Management maintains a listing of rental apartments, rooms and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer

questions and aid students in their attempt to obtain housing off campus. Information on commercial complexes in the Durham area may be obtained by writing to the Off-Campus Housing Office, 217 Anderson Street, Durham, NC 27705. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the university nor its agents negotiate between owners and interested parties. The search for accommodations should begin as soon as possible after acceptance. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the availabilities.

**Dining Facilities.** Duke Dining Services operates a variety of dining facilities including cafeterias, snack bars, restaurants, salad bars, and more. Students may make food purchases in dining establishments with cash, or they may choose to open a pre-paid account. Information about the various types of accounts is available from the DukeCard Office, 024 Union West, Box 90911, Durham, North Carolina 27708-0911, 919/684-5800.

Cafeterias operated by the hospital are available both in the Medical Center and the Veterans Administration Medical Center.

**Student Financial Aid.** Duke University recognizes the responsibility of students and their families to provide funds according to their ability to achieve the educational objective. Students are encouraged to pursue every available source of support through their local and state student assistance programs.

All programs are approved for veterans education benefits (G.I. bill) for those who are eligible. Some of the programs have limited student support available through stipends or special scholarships.

Financial aid is available through Duke in limited amounts in the form of loans. When all institutional funds are pooled, the amount available to a totally needy student is inadequate to meet the school's recognized costs. A Free Application for Federal Student Aid (FAFSA) and a Financial Aid Form (FAF) from applicants and their parents (and spouse, if applicable) is required in addition to the Duke University Financial Aid Application. A copy of the student's (and spouse's, if applicable) federal income tax return for the previous taxable year is required. In the case of the dependent student, a copy of the parent's federal income tax return for the last taxable year is also required. Duke University reserves the right to decline to approve loan applications for those applicants who do not have a satisfactory credit history. U.S. citizenship or permanent residence visa is required of all students receiving loans through the school.

It is the responsibility of recipients of financial aid to keep the Medical Center Office of Financial Aid informed of any outside financial assistance they may receive. It must be understood that Duke reserves the right to reconsider its offer of financial assistance in the event of a major outside award to a recipient. No financial aid funds may be used during a period when the recipient is not involved with work toward the degree or certificate. Less than half-time or special students are not eligible for financial aid.

Students who have been accepted for matriculation routinely receive financial aid applications. Annual reapplication is required of all financial aid recipients.

*Pell Grant (formerly BEOG)* is a federally funded grant for students with financial need who have not earned a baccalaureate degree and are enrolled in any postsecondary educational program. To apply the applicant completes a Free Application for Federal Student Aid (FAFSA) which may be obtained from a high school guidance counselor or from any financial aid office.

*North Carolina Student Incentive Grant (NCSIG)* is available to residents of North Carolina who are enrolled in any postsecondary educational program in North Carolina. The applicant must demonstrate substantial financial need and must not have earned a baccalaureate degree. Application deadline is 1 March for the following academic year. To apply the applicant completes a Free Application for Federal Student Aid (FAFSA) requesting that the information be sent to College Foundation, Inc., 1307 Glenwood



Avenue, Raleigh, North Carolina 27605. FAFSAs may be obtained from a high school guidance counselor or financial aid office.

**North Carolina Student Loan Program for Health, Science, and Mathematics.** These loans provide financial assistance to North Carolina residents who demonstrate need as determined by the board. Loans are available for study in the medical fields, mathematics, and science programs that lead to a degree. The applicant must be a domiciliary of North Carolina and accepted as a full-time student in an accredited associate, baccalaureate, master's, or doctoral program leading to a degree. Loan recipients in professional or allied health programs may cancel their loans through approved service in shortage areas, public institutions, or private practice. Medical students may receive up to \$7,500 per year for each of the four years; master's degree students are eligible for two loans of up to \$5,000 each; bachelor's degree students are eligible for three loans of up to \$4,000 each. For application forms and more information write: Executive Secretary, Board for Need-Based Student Loans, P.O. Box 20549, Suite 304, 3824 Barrett Drive, Raleigh, North Carolina 27619-0549, or telephone (919) 571-4182.

Every effort will be made to assist the student with tuition and living expenses within the framework of school policies which may be in effect at the time. However, as funds are limited, prior indebtedness will not be given favorable consideration as part of the student's budget. A financial aid brochure and student budget for each allied health program are available, upon request, in the spring of each year. Any applicant having further questions may write to Mrs. Nell Andrews, Director, Financial Aid, 126 Davison Building, Box 3067, Duke University Medical Center, Durham, North Carolina 27710.

**Student Health Service.** Student health service, health insurance, and counseling and psychological services, fully described in an earlier portion of this bulletin, are available to all allied health students.

**Judicial System and Regulations.** Duke University expects and requires of all its students full cooperation in developing and maintaining high standards of scholarship and conduct. Each student is subject to the rules and regulations of the university which are currently in effect or which are, from time to time, put into effect by the appropriate authorities of the university. At the same time, the individual is responsible for decisions and choices within the framework of the regulations of the community as Duke does not assume in loco parentis relationships.

Any student, in accepting admission, indicates a willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the university to take such disciplinary action, including suspension or expulsion, for failure to abide by these regulations or for other conduct adjudged unsatisfactory or detrimental to the university. A copy of the Allied Health Judicial System including a code of ethics, rules of conduct, and judicial procedures is provided each student.

**Fees for Transcripts.** Requests for transcripts of academic records should be directed to the Office of the Medical Center Registrar. A fee of three dollars, payable in advance, is charged for each copy. However, the transcript fee is waived for financially needy students who require transcripts to apply for external funding.

**Student Health Fee.** All regular full-time students and part-time degree candidates are required to pay a health fee that is nonrefundable after the first day of classes in the semester. The student health fee entitles the student to outpatient treatment through the Student Health Service, inpatient treatment in the Infirmary, and use of Counseling and Psychological Services. The health fee is not to be confused with the Duke Student Accident and Sickness Insurance (the premium for this insurance is minimized due to the existence of the Student Health Services) which covers a large number of medical costs above and beyond the treatment available through the Student Health Services.

The identification of a separate student health fee in no way changes the policy concerning the Student Accident and Sickness Insurance. Student Health brochures are available in the bursar's office and in the Student Health Service Clinic.

**Student Accident and Sickness Insurance.** At the beginning of each fall semester, medical and allied health students must provide proof to the bursar's office of coverage under an accident and sickness insurance policy or purchase the Duke Student Accident and Sickness Insurance policy. This insurance policy provides protection twenty-four hours per day during the twelve-month term of the policy of each student insured. Students are covered on and off the campus, at home, while traveling between home and school, and during interim vacation periods.

### Refunds

If a student withdraws, tuition is refunded according to the following schedule:

<b>Withdrawal from Master's Programs</b>	<b>Refund</b>
Before classes begin	full amount
During first or second week	80 %
During third to fifth week	60 %
During sixth week	20 %
After sixth week	None

<b>Withdrawal* from Certificate Programs Refund</b>	
Before classes begin	full amount
During first week	80 %
After first week of classes	None

\*Includes involuntary withdrawal for academic reasons.



# The Master of Health Sciences in Biometry

## THE BIOMETRY TRAINING PROGRAM

Program Directors: William E. Wilkinson, Ph.D. and John R. Feussner, M.D.

This training program meets an existing need at Duke University Medical Center for formalized academic training in the quantitative and methodological principles of clinical investigation. Designed primarily for Duke clinical fellows who are training for academic careers, the program offers formal courses in biostatistics, research design, decision analysis, and the use of computers for processing and analyzing medical data. Students who complete a prescribed course of study in the training program are awarded a Master of Health Sciences in Biometry degree by the School of Medicine.

The Biometry Training Program is offered by the faculty of the Division of Biometry in the Department of Community and Family Medicine with the participation of other members of the Medical Center faculty having expertise in relevant areas.

**Degree and Nondegree Admission.** All persons wishing to take courses in the Biometry Training Program, even on a nondegree basis, must be admitted to the program or be currently enrolled in a graduate degree-granting program at Duke. A bachelor's degree (or the equivalent) from an accredited institution is a prerequisite for admission either as a degree candidate or as a nondegree student.

A student seeking admission to the Biometry Training Program should obtain an application packet which contains the necessary forms and detailed instructions on how to apply. Requests for application forms or for additional information about the training program should be directed to the Biometry Training Program, Box 2914, Duke University Medical Center, Durham, North Carolina 27710, (919) 286-8220.

A complete application for nondegree admission requires only the application form and an official transcript from each post-secondary institution attended. Applicants with an M.D., Ph.D. or equivalent degree who are currently medical residents, fellows or faculty members at Duke are not required to submit transcripts for nondegree admission.

A complete application for admission as a degree candidate consists of the application form and the following supporting documents: (1) an official transcript from each post-secondary institution attended; (2) three letters of evaluation written by persons qualified to testify to the applicant's capacity for graduate work; (3) official scores on the Graduate Record Examination General (Aptitude) Test. (GRE scores are not required for applicants having an M.D., Ph.D. or equivalent degree.)

In the event that a nondegree student is subsequently admitted as a degree candidate, relevant course work will be accepted for degree credit.

**Program of Study.** The degree requires 24 units of graded course work and a research and thesis project for which six units of credit are given. Four courses constituting 12 units are required for all degree candidates: 211, 212, 222 and 224 (see Courses of Instruction below). The student's clinical research activities provide the setting and the data for the project; the thesis serves to demonstrate the student's competence in the use of quantitative methods in medical research.

The program is designed for part-time study, allowing the fellow/student to integrate the program's academic program with his or her clinical training. The ten-month academic year consists of three terms: a sixteen-week fall term, a twelve-week spring term beginning in January and a twelve-week summer term beginning around 15 April. (The exact dates are determined by the Medical School's calendar for fourth year medical students.)

**Examining Committee.** The faculty member who directs the student's research project and two other faculty members constitute an examining committee to certify that the student has successfully completed this degree requirement. The chairperson and



at least one other member of this committee must have an appointment in the Division of Biometry; the constitution of each examining committee must be approved by the program directors.

**Grades.** Grades in the Biometry Training Program consist of *H* (High Pass), *P* (Pass), *L* (Low Pass) and *F* (Fail). In addition, an *I* (Incomplete) indicates that some portion of the student's work is lacking, for a reason acceptable to the instructor, at the time grades are reported. The instructor who gives an Incomplete for a course may specify a date by which the student must make up the deficiency. In exceptional circumstances, an Incomplete that is not resolved within one calendar year from the date the course ended may be extended for one additional year with the written approval of the course instructor and the program director. If an Incomplete is not resolved within the approved period, the grade of *I* becomes permanent and may not be removed from the student's record.

A student's enrollment as a degree candidate is terminated if he or she receives a single grade of *F* or two grades of *L* in the program. For these purposes, *WF* (see below) and a permanent *I* are both considered to be failing grades.

**Withdrawal from a Course.** A course may be dropped at the student's discretion during the first three weeks of class; no grade is recorded and all tuition is refunded. If a course is dropped later in the term, no tuition is refunded and the status of the student at the time of withdrawal is indicated on the permanent record as *WP* (Withdrew Passing) or *WF* (Withdrew Failing).

**Tuition.** Tuition for the 1995-96 academic year is \$415 per unit. Faculty members and some fellows may be eligible for the university's Educational Assistance Program. Other sources of support exist in some clinical departments; prospective students should consult with program directors and division chiefs regarding potential funding sources.

**Transfer of Credit.** Transfer of credit for graduate work completed at another institution is considered only after a student has earned a minimum of 12 units in the Biometry Training Program. A maximum of 6 units of credit may be transferred for graduate courses completed at other institutions. Such units will be transferred only if the student received a grade of *B* (or its equivalent) or better. The transfer of graduate credit does not reduce the required minimum registration of 30 units for the degree. However, a student who is granted such transfer of credit may be permitted to register for as much as 12 units of thesis research instead of the usual 6 units.

## Courses of Instruction

**BTP-211. Probability and Statistical Inference.** Laws of probability, probability distributions, descriptive statistics, graphical displays of relationships, philosophy of statistical tests, tests for differences in central tendency, paired comparisons and correlation. Parametric and nonparametric procedures. Simple linear regression and one-way analysis of variance. 4 units.

**BTP-212. Design of Etiological, Clinical and Experimental Studies.** General principles and issues of study design. Observational studies, including descriptive (correlational, case report, cross-sectional) studies, cohort and case-control designs, their relative advantages, and statistical methods used in their analysis. Classical designs (parallel group, randomized block, and cross-over) will be surveyed. Introduction to controlled clinical trials and to sequential design strategies. Ethical considerations will be discussed. Prerequisite: BTP 211. 3 units.

**BTP-217. Clinical Decision Analysis.** Using formal methods for analyzing complex patient management problems. Structuring problems as trees. Applying data from the literature to estimate the likelihood of outcomes. Quantitating the value of health

outcomes. Calculating the strength of preference for one strategy over others. Decision analysis as a guide to clinical research and as a policy tool. Prerequisite: BTP 211. 3 units.

**BTP-222. Statistical Programming in SAS.** Creating, manipulating and analyzing research data using SAS. Prerequisites: BTP 211 (may be taken concurrently) and experience with PC-DOS. 2 units.

**BTP-223. Statistical Programming in S.** Introduction to the S language for statistical computations and graphics using S-Plus on UNIX or Microsoft Windows. Inputting raw and SAS datasets, different types of variables, logical expressions, computing derived variables, coding data, file organization, describing data numerically and graphically, exploratory data analysis using interactive graphics, specifying statistical models, writing your own functions, accessing the international community of S users and acquiring new functions from the Internet. Prerequisite: BTP 211. 1.5 units.

**BTP-224. Regression Models.** Formulation of linear regression models and definition of model parameters in the context of multivariable regression, analysis of variance and analysis of covariance. Techniques for graphically checking model assumptions and testing lack of fit. Model validation, the effect of modeling too many variables and methods for reducing the number of variables to model. Introduction to the logistic and Cox proportion hazards regression models. Prerequisites: BTP 211 and 222. 3 units.

**BTP-225. Statistical Graphics.** A practical theory of presentation and exploratory graphics, accompanied by numerous examples of both poor and excellent graphics. Graphical techniques include: quantile plots, plots of transformations and of cumulative frequency distributions, box plots, histograms, stem-and-leaf diagrams, dot charts, scatterplots, jittering, smoothing, coplots, scatterplot matrices, and multiway dot charts. SAS macros and Splus functions for implementing these techniques will be introduced. Prerequisite: BTP 222 or 223. 1.5 units.

**BTP-226. Categorical Data Analysis.** Methods for analyzing nominal and ordinal response variables, including chi-square tests of independence and homogeneity, Mantel-Haenszel tests, logistic regression models, and weighted least squares fitting of linear models. Measures of association such as Kendall's tau, Spearman's rho, the relative risk, and the odds ratio. Prerequisite: BTP 224. 2 units.

**BTP-227. Nonparametric Statistical Analysis.** General methods for analyzing non-normally distributed data. Specific topics include testing of goodness of fit, inferences concerning location and scale in one and two sample problems, general distribution tests for two or more independent samples and association analysis. Prerequisite: BTP 211. 2 units.

**BTP-228. Survival Analysis I.** General aspects of time-to-event analysis, including basic concepts such as censoring and event times. Construction of actuarial and Kaplan-Meier survival curves. Testing for equivalence of survival distributions. Parametric and Cox regression modeling. Assessment of relative hazards and proportional hazards assumption. Laboratory exercises involving analysis of clinical and epidemiologic follow-up data. Prerequisite: BTP 226. 2 units.

**BTP-229. Modeling Strategies.** General regression models, using splines (piecewise polynomials) to relax linearity assumptions. Modeling 3-dimensional interaction surfaces, fitting ordinal predictors, dealing with missing data, variable selection, collinearity, and shrinkage. Data reduction methods when there are too few observations for the number of variables of interest. Overly influential observations. Using bootstrapping for validating fitted models honestly for calibration and discrimination. Classification and regression trees. Interpreting fitted models using effect (e.g., odds ratio) plots, nomograms, and tree approximations. Methods for comparing two models. The S

language for statistical modeling. Detailed case studies. Prerequisites: BTP 223 (may be taken concurrently) and 224. 3 units.

**BTP-230. Communicating and Critiquing Statistical Methods in Medical Research.** Fundamentals of scientific and statistical communication, including organization of scientific papers using statistics, are illustrated through writing and critiquing articles applying linear and logistic regression, categorical data analysis, survival analysis and other techniques. Grant preparation and grantsmanship. Prerequisite: BTP 224. 3 units.

**BTP-231. Clinical Trials.** Fundamental concepts in the design and analysis of clinical trials. Topics include protocol management, sample size calculations, determination of study duration, randomization procedures, multiple endpoints, study monitoring and early termination. Prerequisite: BTP 228. 3 units.

**BTP-232. Survival Analysis II.** Regression models for analyzing survival time data, including the Cox proportional hazards model and parametric survival models (e.g., exponential, Weibull, log-normal). Overview of maximum likelihood estimation, types of censoring, hazard function, estimating life expectancy, competing risks and multiple endpoints. Using residuals and other methods for checking model fit. Quantifying predictive ability in presence of censoring. What to do if proportional hazards fails. Graphical methods for presenting results. Use of bootstrapping for validating fitted survival models. Using the S language (and overviews of SAS) for survival modeling. Prerequisites: BTP 228 and 229. 1.5 units.

## The Pathologists' Assistant Program

### MASTER OF HEALTH SCIENCES CURRICULUM

#### Pathologists' Assistant Program Core Faculty

Professor and Chairman, Department of Pathology: Salvatore V. Pizzo, M.D., Ph.D.

Director, Pathologists' Assistant Program and Assistant Professor: James G. Lewis, Ph.D.

Medical Director, Pathologists' Assistant Program, Director of the Autopsy Service and Associate Professor: Alan D. Proia, M.D., Ph.D.

Medical Director for Surgical Pathology Assistant and Assistant Professor: Marcia Gottfried, M.D.

Director of Surgical Pathology and Associate Professor: Lester Layfield, M.D.

Surgical Pathology Training Coordinator: Pamela Vollmer, B.H.S.

Director, Autopsy Service, Veterans Affairs Medical Center and Assistant Clinical Professor: Jane Gaede, M.D.

Director of Surgical Pathology, Veterans Affairs Medical Center and Assistant Clinical Professor: Robin Vollmer, M.D.

Chief, Pediatric Pathology and Professor: William D. Bradford, M.D.

#### Attending Pathologists

Professors: Edward Bossen, M.D.; Doyle Graham, M.D., Ph.D.; Robert Jennings, M.D.; Keith Reimer, M.D., Ph.D.; Stanley Robboy, M.D.; John Shelburne, M.D., Ph.D.; Joachim Sommer, M.D.; Benjamin Wittels, M.D.

Associate Professors: Victor Roggli, M.D.; Peter Zwadyk, Ph.D.

Assistant Professors: Marcia Gottfried, M.D.; David Howell, M.D., Ph.D.; Christine Hulette, M.D.; Richard Levenson, M.D.; Roger McLendon, M.D.; Howard Ratech, M.D.; Charles Steenbergen, M.D., Ph.D.

**Program of Study.** This is a twenty-four month program beginning with the start of the medical school academic year in August of each year. It provides a broad, graduate level background in medical sciences in support of intensive training in anatomic pathology. With the background in anatomy, histology, physiology, and microbiology, the students will learn pathology at the molecular level in the classroom and be trained and given experience in the microscopic and gross morphology of disease in close one-on-one training with pathology department faculty. They will learn dissection techniques and all technical aspects of anatomic pathology in summer rotations. The





curriculum is designed to produce individuals who fill the gap between the pathologist on the autopsy and surgical pathology services and other technical personnel who work in the tissue processing laboratory.

**Certification.** The curriculum, faculty, facilities, and administration of the program are approved by the national governing body of pathologists' assistants, the American Association of Pathologists' Assistants (AAPA). Graduates are able to sit for the AAPA national certification examination.

**Degree Requirements:** Eighty units of graduate credit are the minimum enrollment for the M.H.S. degree. At the end of the program, there are mandatory comprehensive written, oral, and practical examinations administered by a panel of pathology department faculty which all students must pass for successful completion of the program.

**Grading Policies:** Grades for all courses except the comprehensive final examination will be assigned as follows: excellent/high pass (*H*), good/pass (*P*), satisfactory/low pass (*L*), failing (*F*), and incomplete (*I*). Failure in any course may result in removal from the program. If a student receives two *L*s, the student will be placed on academic probation and required to perform additional studies for the director. All incomplete grades automatically revert to *F* if work is not complete within one semester or one summer session following award of an incomplete grade. The comprehensive final examination will be pass/fail with the award of honors for outstanding students. Students who fail the final can register for one semester to prepare and take the examination again. Any student who fails the final twice can not complete the program.

## Curriculum

### Year 1 Fall

CBI-200 Cell and tissue biology (Intro. Histology)	3 credits
CBI-201 Microscopic anatomy	3 credits
CBI-202 Medical physiology	4 credits
BAA-200 Human anatomy	3 credits
PTH-367 Special topics in pathology	3 credits

### Year 1 Spring

PTH-250 General pathology	4 credits
PTH-251 General pathology laboratory	4 credits
MIC-221 Medical microbiology	4 credits

### Year 1 Summer

Introduction to autopsy pathology	4 credits
Introduction to surgical pathology	4 credits
Histology techniques	4 credits

### Year 2 Fall

PTH-364 Systemic pathology	6 credits
PTH-361 Autopsy pathology	6 credits
PTH-367 Special Topics in Surgical Pathology	6 credits

### Year 2 Spring

PTH-258 Cellular and subcellular pathology	2 credits
PTH-362 Autopsy pathology	4 credits
PTH-367 Special topics in surgical pathology	4 credits

### Year 2 Summer

Autopsy practicum	6 credits
Surgical pathology practicum	<u>6 credits</u>
	80 credits

## Prerequisites for Admission

1. A baccalaureate degree in a biological or chemical science from an accredited institution.
2. A baccalaureate degree in a nonscience major but at least 12 credit hours in biological sciences and six credit hours in chemistry.
3. Scores for the Graduate Record Examination (GRE) taken within the last five years.

Candidates who receive their baccalaureate degree from institutions outside the United States must submit a transcript evaluation showing degree equivalency and subject matter description.

**Application Procedures.** Application materials are mailed to prospective candidates for admission up to March 31 of the year preceding expected matriculation. Applications can be obtained by writing to: Dr. James G. Lewis, Director, Pathologists' Assistant Program, Department of Pathology, Box 3712, Duke University Medical Center, Durham, NC 27710. Telephone: (919) 684-2159. All applications must be received by April 15.

Applications must include:

1. A completed Duke University application form and a nonrefundable application fee of \$35.
2. Official transcripts of all colleges and universities attended.
3. GRE scores.
4. Three letters of recommendation.

Candidates will be notified of the admission committee's decision no later than May 15. Accepted candidates will be required to submit a nonrefundable deposit of \$225 to retain their places in the class. This deposit will apply to tuition.

Tuition, Fees and Estimated Costs for Year One:

<b>Tuition</b>	\$12,400 (40 credits at \$310/credit)
Fees	500
Books	400
Lab coats	120
Student health fee	(\$192/semester) 576
Student accident and health insurance	618 (single) \$1,942 (family)
Vehicle registration	120
Lodging	4,353
Food	3,487
Miscellaneous	3,818
	<u>\$26,405</u>

**Financial Aid.** Please refer to the section on student aid in the chapter, The Allied Health Programs. For more detailed information contact the Office of Financial Aid, Box 3067, Duke University Medical Center, Durham, NC 27710.

### Courses of Instruction

**BAA-305. Gross Human Anatomy.** This is the medical school and anatomy graduate course in human anatomy. Students participate in a complete lecture series and in laboratory dissections of cadavers. Lectures and laboratory work are supplemented by conferences which emphasize biological and evolutionary aspects. 3 credits. *Staff*

**CBI-200. Cell and Tissue Biology.** This is the introductory medical school and graduate course in microscopic anatomy. Student participates in lectures and laboratories on the structure and function of cells and tissues of the body. Practical experience in the use of the light microscope analyzing an extensive slide collection of mammalian tissues. 3 credits. *McIntosh and staff*

**CBI-201. Microscopic Anatomy.** Histology of all major organs of the body. Structure and cell biology at both the level of the light and electron microscope. 3 credits. *McIntosh and staff*

**CBI-202. Medical Physiology.** Medical and graduate level course on organ and cell physiology. Human and medical aspects are stressed. 4 credits. *Somjen and staff*

**MIC-221. Medical Microbiology.** Intensive study of common bacteria, viruses, fungi, and parasites that cause human disease. The didactic portion focuses on the nature and biological properties of microorganisms causing disease, the manner of replication, and their interaction with the entire host as well as specific organs and cells. 4 credits. *Staff*

**PTH-250. General Pathology.** This is the medical school core course in pathology. Lectures deal with broad concepts of disease and underlying molecular mechanisms. 4 credits. *Staff*

**PTH-251. Laboratory Course in General Pathology.** Fundamentals of pathology are presented by correlating gross and microscopic material to illustrate the structural changes in disease. Laboratories are broken into small groups of students and are held under the guidance of staff pathologists. 4 credits. *Staff*



**PTH-258. Cellular and Subcellular Pathology.** The course consists of lectures and seminars on the alterations of cellular structure and associated functions that accompany cell injury. 2 credits. *Shelburne and staff*

**PTH-361 and PTH-362. Autopsy Pathology.** A detailed consideration of the morphologic, physiologic, and biochemical manifestations of disease. Gross dissection, histologic examinations, processing, analyzing of all autopsy findings under tutorial supervision. 6 credits each course. *Lewis and staff*

**PTH-364. Systemic Pathology.** This is the medical school and graduate course in the detailed pathology of major organ systems. The course consists of lectures and seminars presenting the latest scientific concepts of disease. 6 credits. *Bradford and staff*

**PTH-367. Special Topics in Pathology.** This course consists of seminars and laboratories. It will be taken in the first semester as an introduction to anatomic pathology. It will be taken again in the second year in which the fundamentals of the handling and evaluation of human surgical pathology material will be stressed. 4 credits. *Lewis, Vollmer and staff*

## **Rotations**

**Introduction to Autopsy Pathology.** This rotation is given during the first summer session. It is designed to acquaint the students with techniques in autopsy prosection and workup. Students will assist house staff in autopsy dissections. 6 credits. *Lewis and staff*

**Introduction to Surgical Pathology.** This rotation is given during the first summer session. It is designed to acquaint the students with the techniques of gross dissection, description, and submission of tissue blocks in the surgical pathology laboratory. 6 credits. *Vollmer and staff*

**Histology Techniques.** This rotation is given in the first summer session. It is designed to give the students an understanding of the fundamentals of tissue processing, staining, histochemistry, and immunohistology. *Smith and staff*

**Autopsy Practicum.** This rotation is given during the last summer session before graduation. The students will perform complete autopsies under the supervision of house staff. They will perfect routine and special dissection skills, microscopic descriptions, report writing, and gross and microscopic photography. 6 credits. *Lewis and staff*

**Surgical Pathology Practicum.** This rotation is given during the last summer session before graduation. The students will perfect skills at gross dissections and description dictation under the supervision of house staff. 6 credits. *Vollmer and staff*

# **The Physician Assistant Program**

## **MASTER OF HEALTH SCIENCES CURRICULUM**

### **Physician Assistant Program Core Faculty**

Program Director: Reginald D. Carter, Ph.D., PA

Medical Director: Joyce A. Copeland, M.D.

Associate Program Director: Patricia M. Dieter, PA-C, M.P.A.

Director of Clinical Education: Philip A. Price, PA-C, M.H.S.

Director of Preclinical Education: J. Victoria Scott, PA-C, M.H.S.

Director of Recruitment and Minority Affairs: Lovest T. Alexander, PA-C, M.H.S.

Clinical Medicine Coordinator: John C. Lord, PA-C, B.H.S.

Surgical Coordinator: Paul C. Hendrix, PA-C, M.H.S.

FAHEC Clinical Coordinator: Gloria J. Jordan, PA-C, B.H.S.

The physician assistant (PA) concept originated at Duke over two decades ago. Dr. Eugene A. Stead Jr., then chairman of the Department of Medicine, believed that midlevel practitioners could increase consumer access to health services by extending

the time and skills of the physician. Today, physician assistants are well-recognized and highly sought-after members of the health care team who, working interdependently with physicians, provide diagnostic and therapeutic patient care in virtually all medical specialties and settings. They take patient histories, perform physical examinations, order laboratory and diagnostic studies, and develop patient treatment plans. In thirty-five states, including North Carolina, PAs have the authority to write prescriptions. Their job descriptions are as diverse as those of their supervising physicians, and may also include patient education, medical education, health administration and research.

The role of the graduate PA has evolved substantially over the past twenty-five years. While the majority of PAs in clinical practice continue to provide primary care services, the percentage serving in solo practice or private group settings has declined while the percentage practicing in institutional settings has risen. Today, over half of all graduate PAs are employed in large clinics, hospitals and institutional settings. There are also more nonclinical positions developing for PAs; while these positions do not involve patient care, they depend on a strong clinical knowledge base (e.g., drug study coordinator, clinical services coordinator, etc.).

In recognition of the increased responsibilities and expanded roles of PAs, the increased number of applicants with college degrees, and the quality of the PA educational program, the university began offering the Master of Health Sciences (M.H.S.) degree to graduates in 1992. The M.H.S. curriculum is designed to provide PAs a greater depth of knowledge in the basic medical sciences and clinical medicine, as well as skills in administration and research. With these expanded skills, graduates can take advantage of the wide diversity of positions available to PAs.

**Program of Study.** The curriculum is twenty-five consecutive months in duration and is designed to provide an understanding of the rationale for skills used in patient assessment, diagnosis, and management. The first twelve months of the program are devoted to preclinical studies in the basic medical and behavioral sciences, and the remaining thirteen months to clinical experiences in primary care, medical and surgical specialties, and research study.

The preclinical curriculum is integrated in such a way as to introduce the student to medical sciences as they relate to specific organ systems and clinical problems. Learning strategies include the traditional lecture format and basic science laboratory, small group tutorials, and computer-assisted diagnostics using simulated patients. Regular patient contact is an important part of the first year curriculum. Students begin to see patients during the spring semester as part of the Patient Assessment course; this patient contact continues throughout the summer term of the first year.

As part of the clinical practicum, students are required to take rotations in inpatient medicine, surgery, emergency services, outpatient medicine, pediatrics, obstetrics/gynecology, and behavioral medicine. In addition to these rotations, three elective clinical rotations are included in the clinical year schedule, as is a four-week period devoted to development of a written research protocol. At least one clinical rotation must be completed in a medically underserved site. The final four weeks of the clinical year are spent in a specialty of the student's choosing; this final preceptorship often serves as a bridge to employment as a practicing PA.

Because the clinical teaching is carried out in many practice settings throughout North Carolina and the southeast, students should plan on being able to travel away from the Durham area for part of their clinical experience.

**Curriculum.** Before proceeding into the clinical phase of the curriculum, students must satisfactorily complete the following:

## Preclinical Year

### Fall Semester

PAP-200. Basic Medical Sciences	5 credits
PAP-205. Anatomy	4 credits
PAP-210. Laboratory Medicine	4 credits
PAP-215. Physical Diagnosis	3 credits
PAP-220. Clinical Medicine I	<u>4 credits</u>
	20 credits

### Spring Semester

PAP-211. Laboratory Medicine II	1 credit
PAP-221. Clinical Medicine II	9 credits
PAP-230. Fundamentals of Surgery	5 credits
PAP-235. Patient Assessment I	2 credits
PAP-240. Behavioral Aspects of Medicine	<u>2 credits</u>
	19 credits

### Summer Term

PAP-222. Clinical Medicine III	7 credits
PAP-236. Patient Assessment II	1 credit
PAP-245. Perspectives on Health	2 credits
PAP-250. Health Systems Organization	2 credits
PAP-255. Introduction to Research and Epidemiologic Principles	<u>3 credits</u>
	15 credits

## Clinical Year

Following successful completion of the preclinical courses, students enter the clinical phase of the program, completing the following experiences:

PAP-300. Outpatient Medicine	4 credits
PAP-305. Research Period	3 credits
PAP-310. Behavioral Medicine	4 credits
PAP-320. Inpatient Medicine	8 credits
PAP-340. General Surgery	4 credits
PAP-350. Emergency/Outpatient Surgical Service	4 credits
PAP-360. Pediatrics	4 credits
PAP-370. Obstetrics/Gynecology	4 credits
Elective	4 credits
Elective	4 credits
Elective	4 credits
PAP-390. Preceptorship	<u>4 credits</u>
	51 credits

The student receives four credits for rotations which are four weeks in length, and eight credits for rotations which are eight weeks in length.

In addition to successful completion of the preclinical and clinical phases of the program, the PA student must also complete BLS, ACLS, and the research period. The four-week research period is scheduled during the clinical training period.

**Program Policies and Grading Standards.** Grades for all courses and clinical rotations within the Physician Assistant curriculum will be assigned on the basis of the following: honors (*H*), pass (*P*), low pass (*L*), and fail (*F*). The Physician Assistant Program is designed to integrate classroom and clinical learning experiences considered necessary for competency as health care providers. Therefore, the failure of any required



course will prevent a student from continuing in the program. Also, a student can receive no more than a total of four grades of "low pass" in the twenty-seven required courses during the clinical and preclinical phases of the program. Determination of satisfactory academic progress is made by the PA faculty at the conclusion of each semester/term.

A grade of "incomplete" (I) may remain on a student's transcript for one year only. After one year, a grade of "incomplete" will automatically be converted to an F (fail). An extension to this one year limit may be granted by the program director; a request must be submitted in writing to the program director no later than thirty days prior to the expiration of the one year time limit.

Students in the Physician Assistant Program are participants in a professional training program whose graduates assume positions of high responsibility as providers of health care. Accordingly, students are evaluated not only on their academic and clinical skills but also on their interpersonal skills, reliability, appearance and professional conduct. Deficiencies in any of these areas will be brought to the student's attention in the form of a written evaluation and may result in probation, suspension or expulsion from the program.

**Attendance and Excused Absences.** Students are expected to attend all lectures, laboratories and seminars. Absences are excused only for illness or personal emergency, and students are expected to notify program faculty in advance of an expected absence.

**Leave of Absence.** A PA student, after presenting a written request to the PA program director, may be granted an official leave of absence for personal, medical, or academic reasons for a period not to exceed one calendar year. If the leave of absence is approved, the program director provides written notification including applicable beginning and ending dates to the student, the registrar, and the director of financial aid. The student must apprise the program director in writing of his or her wish to return to the PA Program or to extend the personal leave at least sixty calendar days prior to the anticipated date of re-entry. The student desiring an extension beyond one calendar year may be required to apply for readmission to the PA Program. When a leave of absence is taken, the program director may require the student to repeat some or all of the courses completed prior to the leave of absence. In all cases of leave of absence, the student is required to complete the full curriculum to be eligible to earn the PA certificate.

For purposes of deferring repayment of student loans during a school approved leave of absence, federal regulations limit the leave to six months.

**Prerequisites for Admission.** The prerequisites for admission to the M.H.S. physician assistant curriculum include:

1. A baccalaureate degree from an accredited institution. College seniors are eligible to apply, provided they will receive the baccalaureate degree prior to the August starting date for the PA Program. Those candidates who received their baccalaureate degrees from colleges and institutions outside of the United States must complete at least one year (30 semester credits) of additional undergraduate or graduate study at a U.S. college or university prior to application to the program.
2. Preparatory science courses, including at least 11 semester hours in the biological sciences and 8 semester hours in chemistry. These courses must be completed with grades of "C" or better. Preference will be given to candidates who have completed courses in anatomy, physiology, microbiology, and statistics. Applicants from all academic disciplines are welcome, provided they meet the preparatory science course prerequisites.
3. Scores of the Graduate Record Examination (GRE general test), taken within the last five years.
4. A minimum of six months (1,000 hours) of health care experience, preferably with direct "hands-on" patient contact.

**Application Procedures.** Application materials are mailed to prospective applicants from 1 June through 1 December each year, and may be obtained by writing: Admissions Coordinator, Physician Assistant Program, Box CFM 2914, Duke University Medical Center, Durham, NC 27710, telephone: (919) 286-8234. Applications are accepted by the university no earlier than 1 July and no later than 15 December for the new class which enters in August each year. Applications must contain:

1. A completed official application form, including a nonrefundable fee of \$45.
2. Official transcripts from all colleges/universities and other postsecondary institutions attended.
3. Scores of the Graduate Record Examination (GRE). Applicants should take the GRE in October or earlier.
4. Three letters of recommendation, to include one from a health care provider with whom the applicant has worked.

**Selection Factors.** The program has a specific interest in enrolling students from diverse social, ethnic, and educational backgrounds. Emphasis is placed upon personal maturity, quality of health care experience, dedication to the health field, and academic potential. Information submitted by each applicant is carefully reviewed by the Committee on Admissions, and selected applicants are invited to Duke University for personal interviews. These interviews take place from January through early March; 44 students are chosen from among those interviewed. **Only full-time students will be admitted.**

Candidates are notified of the admissions committee's decision as soon as possible after the interview, and no later than 1 April. Those candidates who have been accepted are asked to respond in writing with their decision and to confirm their place in the class by submitting the nonrefundable registration and deposit fees by 1 May. Each year, an alternate list is selected; a variable number of candidates from this list are offered a position in the class.

**Tuition and Fees.\*** On notification of acceptance, prospective PA students are required to pay a nonrefundable first registration fee of \$35, as well as a nonrefundable program deposit of \$175. For those who do matriculate, the program deposit is applied to the cost of tuition.

Estimated expenses for the 1995 entering class of the Master of Health Sciences Physician Assistant Program are:

Tuition	\$300/credit (average annual tuition \$15,750 per year)
Books, uniforms, and instruments	\$1,275
Food	\$290 per month
First Year Fee (laboratory, etc.)	\$750
Lodging	\$362 per month
Student Health Fee	\$192 per semester
Student Accident and Sickness Insurance	\$618 per year—single
	\$1,942 per year—family
Miscellaneous (travel, clothing, etc.)	\$318 per month

\*These are estimated figures only. Tuition and fees are subject to change without notice.

**Health Insurance.** All students are required to carry adequate health insurance throughout their enrollment in the PA program. If the student does not elect to take the Duke Student Accident and Sickness Insurance policy, evidence of other comparable health insurance coverage must be provided. The Student Health Fee is mandatory for all students.

**Financial Aid.** Qualified students may be eligible for government sponsored loans up to \$8,500. In addition, funds are available from the program's institutional loan fund. A limited amount of scholarship funds will also be available for 1995-96. All financial



aid awards are made on the basis of documented financial need. Financial aid application packets are distributed on the admissions interview date.

The U. S. Public Health Service has several programs which offer scholarships, stipends and loan repayment to PA students who commit to varying periods of employment within USPHS facilities. Interested applicants can call either the PA program or the National Health Service Program directly at 1-800-221-9393 for further information.

Applicants are encouraged to request information and application forms from clubs, organizations, foundations and agencies as soon as possible after applying for admission to the program. Many libraries have information on sources of financial aid. Also, the financial aid offices at nearby colleges and universities often have information on sources of funding.

With the program director's approval, first-year students may be employed up to twenty hours per week. **Because of the demands of the clinical year, it is difficult or impossible for the second-year student to work.**

More detailed information regarding financial aid can be obtained from: Office of Financial Aid, Box 3067, Duke University Medical Center, Durham, NC 27710.

**Commencement.** To receive the MHS degree at the May commencement ceremony, the physician assistant student must successfully complete 89 credits, including all preclinical courses, the research period, and all clinical rotations scheduled to that date. The PA program certificate of completion is awarded four months later in early September, following the student's completion of a total of 105 credits, including the remaining clinical rotations and the final preceptorship.

PA students should be aware that failure to begin or complete a clinical rotation as scheduled could delay receipt of both the MHS degree and the PA program's certificate of completion. Furthermore, any incomplete rotations will have to be made up prior to receiving the certificate of completion.

### **Courses of Instruction**

Course credits are the recognized units for academic work in the PA Program. All courses are required and no transfer credit is accepted.

#### **Preclinical Year Courses**

**PAP-200. Basic Medical Sciences.** The basic facts, concepts and principles that are essential in understanding the fundamental mechanisms of human physiology, pathology, pharmacology and nutrition. This course presents the basic methods of clinical problem solving, and serves as a prerequisite to the clinical medicine course by emphasizing the underlying principles of the etiology, management and prevention of disease processes. 5 credits. *Carter*

**PAP-205. Anatomy.** Functional and applied anatomy as it relates to physical diagnosis and common clinical findings. Cadaver dissections, lectures, and audiovisual materials are used in the anatomy component of the course. 4 credits. *Hendrix*

**PAP-210, 211. Laboratory Medicine I, II.** An introduction to the performance and interpretation of routine hematologic, urinary, microbiologic, and other laboratory procedures commonly used in practice. This course is taught by faculty/staff from the Department of Pathology, Medical Technology Program and the Hospital Laboratories. 5 credits. *Schmidt*

**PAP-215. Physical Diagnosis.** An introduction to the techniques for performing and recording the physical examination. Taught in small-group format; lectures and audiovisuals are used, as well as extensive small group practice sessions. Six weeks of orthopaedic physical diagnosis are included in this course. 3 credits. *Price*



**PAP-220, 221, 222. Clinical Medicine I, II, III.** The essentials of diagnosis and management of the most common clinical problems seen by primary care practitioners. Using an organ systems approach, clinical information is presented in conjunction with appropriate correlative lectures and labs in anatomy, pathophysiology, pharmacotherapeutics, radiology and nutrition. This is a core course around which most other courses are organized. 20 credits. *Lord and Scott*

**PAP-230. Fundamentals of Surgery.** The basic surgical concepts needed for the PA to function in primary care settings as well as major surgical areas. The course emphasizes surgical technique and emergency procedures, as well as asepsis, minor procedures and anesthesia. The animal surgery laboratory is an essential component of this course. 5 credits. *Hendrix*

**PAP-235, 236. Patient Assessment I, II.** An introduction to medical interviewing and the recording and presentation of clinical information. Teaching methods include lectures, small groups and role playing. For the first eight weeks of the course, students concentrate primarily on history-taking, and are assigned by their small-group instructors to interview patients on the wards. During the second eight weeks of the Spring Semester, and during the Summer Term, students are assigned in small groups to fellows from the Department of Medicine. Weekly, each student is assigned to a hospitalized patient to perform a complete history and physical examination. 3 credits. *Dieter*

**PAP-240. Behavioral Aspects of Medicine.** An introduction to the skills, knowledge and sensitivity needed to communicate and intervene effectively in a wide variety of psychosocial situations. 2 credits. *Kertesz*

**PAP-245. Perspectives on Health.** A professional issues review. This course emphasizes current issues facing the profession, including legal and ethical problems, and the unique place of PAs within the health care system. 2 credits. *Scott*

**PAP-250. Health Systems Organization.** An introduction to the structure and administrative principles in use in health care organizations. A lecture series taught by an interdisciplinary faculty and by community experts in health care organization. Topics include the patient as consumer, third-party payment, public policy trends and organizational behavior. 2 credits. *Carter and Dieter*

**PAP-255. Introduction to Research and Epidemiologic Principles.** Foundations of research methodology related to the study of disease distribution and issues in study design, data collection and methods of analysis. The PA student will develop a critical review of the literature pertaining to an assigned clinical research question. 3 credits. *Yankaskas*

## Clinical Year Courses

### COMMUNITY AND FAMILY MEDICINE

**PAP-300. Outpatient Medicine.** This rotation emphasizes the outpatient evaluation and treatment of conditions common at the family medicine/primary care level, and the appropriate health maintenance measures for different age groups. An alternative eight-week track in outpatient medicine is also available for those students who have a vocational interest in primary care. 4 credits. *Staff*

**PAP-305. Research Period.** During a four-week research period in the clinical year, the student attends weekly seminars and develops a written research protocol. This course is a practical application of principles learned in PAP-255. 3 credits. *Yankaskas*

**PAP-310. Behavioral Medicine.** The student is assigned to a psychiatric and/or behavioral clinical setting, either inpatient or outpatient. This rotation facilitates the acquisition of communication and behavioral modification skills which will be useful in the primary care setting. 4 credits. *Staff*

## **MEDICINE**

**PAP-320. Inpatient Medicine.** During this rotation, the student learns to apply basic medical knowledge to the problems and situations encountered on an inpatient service. By collecting a data base, formulating a complete problem list, and participating in daily rounds and in the management of patient problems, the student develops an awareness of the complexity of disease processes and differential diagnosis. 8 credits. *Staff*

## **OBSTETRICS/GYNECOLOGY**

**PAP-370. Obstetrics/Gynecology.** The student learns about common gynecological problems, pregnancy and delivery. Assisting at the operating table may be a significant aspect of the rotation. The rotation emphasizes clinical experience with cancer detection techniques, abnormal menstruation and bleeding, infections and contraception counseling. 4 credits. *Staff*

## **PEDIATRICS**

**PAP-360. Pediatrics.** In this rotation, the student is assigned to either an institutional setting or a community-based pediatric site. Special emphasis is placed on communication skills and relating sensitively to both children and parents. The student gains familiarity with normal growth and development, pediatric preventive medicine, and evaluation and management of common childhood illnesses. 4 credits. *Staff*

## **SURGERY**

**PAP-340. General Surgery.** The student is assigned by the chief resident to one of the surgical teams. This rotation emphasizes preoperative evaluation and preparatory procedures, assisting at the operating table, and management of patients through the postoperative period to discharge. 4 credits. *Staff*

**PAP-350. Emergency/Outpatient Surgical Service.** This rotation stresses the evaluation and management of surgical problems of the ambulatory patient. In the emergency room, the student gains experience in the initial evaluation of potential surgical conditions, and performing problem-specific examinations and minor surgical skills. There is also the opportunity to followup patients on return visits. 4 credits. *Staff*

In addition to the above required core rotations, each student is required to complete three electives, that can be chosen from among the following:

## **COMMUNITY AND FAMILY MEDICINE**

PAP-301. Occupational Medicine

PAP-302. Geriatrics

## **MEDICINE**

PAP-321. Cardiology

PAP-322. Dermatology

PAP-323. Endocrinology

PAP-324. Emergency Medicine

PAP-325. Hematology/Oncology

PAP-326. Hyperbaric Medicine

PAP-327. Infectious Diseases

PAP-331. Nephrology

PAP-332. Neurology

PAP-333. Pulmonary Medicine

PAP-334. Rheumatology

PAP-335. AIDS Clinical Trials Unit

PAP-336. Medical ICU

PAP-337. Coronary Care Unit

## **OPHTHALMOLOGY**

PAP-381. Ophthalmology

## **PEDIATRICS**

- PAP-361. Pediatric Cardiology
- PAP-362. Pediatric Surgery/Cardiothoracic Surgery
- PAP-363. Pediatric Hematology/Oncology
- PAP-364. Pediatric Allergy/Respiratory
- PAP-365. Pediatric Endocrinology
- PAP-366. Pediatric Infectious Disease
- PAP-367. Intensive Care Nursery

## **SURGERY**

- PAP-341. Cardiothoracic Surgery
- PAP-342. Otolaryngology
- PAP-343. Neurosurgery
- PAP-344. Orthopedics
- PAP-345. Plastic Surgery
- PAP-346. Sports Medicine
- PAP-347. Urology
- PAP-351. Emergency Medicine
- PAP-352. Trauma
- PAP-353. Adult Surgical ICU

Each of these electives is 4 credits. In addition to the electives listed above, a limited number of independent studies, in which students construct their own need-specific learning experiences, may be arranged. More detailed information on the elective and independent study rotations may be obtained from the Director of Clinical Education of the Physician Assistant Program.

The final rotation in the PA program, immediately prior to receiving the program certificate of completion in September, is the Preceptorship (PAP-390-4 credits). This required rotation must be completed by all students. Students are encouraged to select a preceptor in the area of their anticipated employment and, during this period of time, to explore the tasks and team aspects of functioning as a midlevel practitioner.

# **Transfusion Medicine Program**

## **MASTER OF HEALTH SCIENCES CURRICULUM**

### **Transfusion Medicine Program Core Faculty**

Professor, Department of Pathology and Director of Clinical Laboratories: Salvatore Pizzo, M.D., Ph.D., *Chairman*

Associate Professor: Peter D. Issitt, Ph.D., F.R.C.Path., *Program Director*

Associate Professor: Emily G. Reisner, Ph.D., *Program Co-Director*

Assistant Professor: Steven J. Bredehoeft, M.D., *Medical Director*

Professor: Wendell Rosse, M.D.

Associate Professor: Marilyn J. Telen, M.D.

Assistant Professors: Donna D. Kostyu, Ph.D.; Margaret C. Schmidt, Ed.D., MT(ASCP)SH, CLSph(NCA); Cynthia L. Wells, Ed.D., MT(ASCP), CLS(NCA)

Clinical Practicum Coordinator: Patty Hanneman, M.S., MT(ASCP)SBB

**Program of Study.** This program, beginning in January of each year, is an intensive study of transfusion medicine, advanced blood banking theory and practice, immunohematology and the basic sciences on which practice of the above disciplines is based. The curriculum is designed to provide in-depth knowledge and experience in administration, supervision, teaching, technical consultation, and research. With these expanded skills the graduate can take advantage of a wide variety of career opportunities available in hospital blood banks and transfusion services, independent blood centers, research and development laboratories, commercial sales and marketing, and educational institutions.



**SBB Certification.** This program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP) of the American Medical Association in association with the American Association of Blood Banks. Students are eligible to sit for the Specialist in Blood Bank Technology examination given by the American Society of Clinical Pathologists usually after completion of the first year of the MHS program.

**Degree Requirements.** Forty-four units of graduate credit constitutes minimum enrollment for the M.H.S. degree. Of these, at least twenty-three must be in transfusion medicine. Seven units of biometry credits must be completed. A minimum of seven units must be completed from choices in related fields that have been approved by the program director. The remaining seven units are earned by the submission of an approved thesis. All students must successfully complete an oral examination before conferral of the degree.

**Thesis Requirements.** The thesis should demonstrate the student's ability to collect, arrange, and report pertinent material on a clinical or research topic. Research may involve a scientific, technical, supervisory, teaching or administrative major area. Requirements of form are set forth in the *Transfusion Medicine Guide for the Preparation of Theses*, copies of which are available from the program director. To receive a degree, the thesis and examination must be completed: before 15 April for a May degree; at least one week before the final day of the second summer term for a September degree, and one week before the final day of the fall semester for a December degree.

**The Examining Committee and Examination.** An examining committee composed of three faculty members will conduct an examination and certify the student's success or failure. Committee members must sign all copies of the thesis.

**Grading Policies.** Grades for all courses will be assigned on the following basis: high pass (H), pass (P), low pass (L), and incomplete (I). Failure (F) in any course will prevent a student from continuing in the program. The instructor may approve the award of an "I" for a course based on a mutually agreed on schedule for completion of the work. The period of time for completion of the work may be no longer than six months. An "I" will convert to an "F" if the coursework is not completed by the deadline established by the instructor.



## Curriculum

<i>Year 1</i>	<i>Course Units</i>
TM-200 Basic Sciences	1.0
TM-205 Immunology	0.5
TM-210 Transfusion Medicine	1.5
TM-215 Genetics and Statistics	1.0
TM-220 Blood Group Systems, I	2.5
TM-240 Seminar, Journal Club, Writing	1.5
TM-250 Education	1.5
TM-260 Management and Supervision	1.5
TM-270 Blood Group Systems, II	2.0
TM-280 Clinical Practicum, I	3.0
TM-290 Clinical Practicum, II	3.0
BTP-211 Probability and Statistical Inference	4.0
Total	23.0
<i>Year 2</i>	
TM-275 Blood Group Systems, III	2.0
TM-285 Immunohematological Disorders	2.0
TM-371 Thesis Research, I	3.0
TM-372 Thesis Research, II	4.0
BTP-212 Design of Etiological, Clinical and Experimental Studies	3.0
Approved electives from established university courses	7.0
Total	21.0

**Prerequisites for Admission.** The prerequisites for admission to this M.H.S. curriculum include:

1. a baccalaureate degree in one of the sciences from an accredited institution or
2. a baccalaureate degree in a non-science major and documented laboratory experience in a scientific setting; and
3. scores of the Graduate Record Examination (GRE general test), taken within the last five years.

Candidates who received their baccalaureate degrees from colleges and universities outside the United States must submit a transcript evaluation showing degree equivalency and subject matter breakdown.

While previous laboratory experience is not an absolute prerequisite, the nature of such experience (if any) will be taken into account in the consideration of an application. Suitable previous experience can be expected to enhance an applicant's chance of admission if there is competition for available spaces in the program.

**Application Procedures.** Application materials are mailed to prospective applicants on request to: Admissions Coordinator, Transfusion Medicine Master's Program, Box 2929, Duke University Medical Center, Durham, NC 27710, telephone 919/684-6015. Normally, applications will be accepted up to October 1 preceding matriculation. However, after October 1, applications will still be accepted, on a space-available basis.

The application must include:

1. a completed official Duke University application form and a nonrefundable application fee of \$35;
2. if certified, a notarized copy of the certificate from the certifying agency;
3. official transcripts from all colleges, universities, and professional schools attended;
4. GRE scores (examinations should be taken preferably no later than October);

5. three letters of recommendation including at least two from employers; and
6. a personal interview with members of the Admissions Committee, if requested, after a review of the completed application file.

Candidates will be notified of the admissions committee's decision as soon as possible after the interview but no later than November 1. Accepted candidates will be required to submit a nonrefundable deposit of \$225 to hold their places in the class. This deposit applies to the tuition fee.

**Tuition and Fees\*:**

*Year 1*

Tuition	\$11,025
Books	427
Laboratory fee	200
Copying fee	200
Student health fee (\$192 per semester)	576
Student accident and health insurance (single)	618
	(family 1,942)
Vehicle registration	120
Lodging/utilities	4,353
Food	3,487
Miscellaneous (travel, clothing, etc.)	<u>3,818</u>
Total	\$24,824

*Year 2*

Tuition	\$11,025
Books	320
Copying fee	200
Research fee	750
Student health fee (\$192 per semester)	576
Student accident and health insurance (single)	618
	(family 1,942)
Vehicle registration	120
Lodging/utilities	4,353
Food	3,487
Miscellaneous (travel, clothing, etc.)	<u>3,818</u>
Total	\$25,267

\*These are estimated figures only. Tuition and fees are subject to change.

**Financial Aid.** Please refer to the Medical Center bulletin section on student aid in the chapter, "The Allied Health Programs." More detailed information is available from the Office of Financial Aid, School of Medicine, Box 3067, Duke University Medical Center, Durham, NC 27710. Based on individual qualifications, students may be eligible for part-time positions in the Clinical Laboratory Services of Duke Hospital.

**Transportation Requirements.** The use of facilities other than Duke Hospital requires transportation. It is the responsibility of each student to provide a means of transportation to and from facilities selected for learning experiences.

**Course Descriptions**

**TM-200. Basic Sciences.** An introduction to the branches of science of importance to transfusion medicine; covers principles and applications of biochemistry, molecular biology, molecular genetics and membrane structure and function. Uses examples from the human blood group systems to illustrate the role of basic science in normal and pathological immune reactions and normal and abnormal function of membrane com-



ponents. Correlations between biochemical structure and function will be presented, using similar examples. 1 credit. *Telen and Rosse*

**TM-205. Immunology.** Principles of the immune response in man to include the humoral and cellular arms. To cover the structure and function of cells of the immune system; antigen processing; primary and secondary immune responses; the genetic control of the immune response; immunologic memory; utilization of effector mechanisms by the immune system and the results of allo- and auto-immunization. 0.5 credit, *Kostyu*

**TM-210. Transfusion Medicine.** Describes hematopathology in terms of normal and abnormal cell production; and coagulopathies in terms of normal and abnormal coagulation. Describes the use of blood and blood products as primary means of treatment in some disorders and as support mechanisms in others and in surgical procedures. Details correct preparation of blood components; calculation of therapeutic doses and the mechanisms by which various components correct clinical abnormalities. Various viruses, bacteria, and parasites that can be transmitted by transfusion will be discussed together with the multitude of selection and testing methods to ensure exclusion of potentially infectious units of blood. 1.5 credits. *Bredehoeft and Schmidt*

**TM-215. Genetics and Statistics.** Describes human genetics in terms of normal and abnormal gene transmission, population studies, inheritance patterns of the human blood groups and use of those blood groups in parentage studies. Particular emphasis is placed on the derivation and use of the Hardy-Weinberg formula. Statistics portion covers principles and applications, experimental design and interpretations of results. Statistics portion builds on material dealing with genetics of the blood groups presented in the first part of the course. 1 credit. *Reisner*

**TM-220. Blood Group Systems, I.** Presents information on blood group antigen-antibody reactions, their potentiation with various additives and their detection by different techniques including the antiglobulin test. Describes the mechanisms and consequences of intravascular and extravascular in vivo red cell destruction including the role of effector mechanisms such as complement activation and macrophage action. Describes the ABO, Lewis, P, I and HLA blood group systems from historical, genetic, immunological, serological, biochemical, and clinical perspectives including disease associations. Describes how unusual deletions or suppressor genes can affect phenotypes and how phenotypes can be used to recognize haplotypes. 2.5 credits. *Issitt and Reisner*

**TM-240. Seminar, Journal Club, Writing.** By faculty-critiqued student reviews of published scientific papers in seminars and journal club, the student will be taught how to evaluate data in the literature. Emphasis will be placed on planning experiments, selecting the most appropriate methods, analyzing the results to determine statistical significance, and interpreting the data for the most likely and other non-excluded explanations; honing of library research skills and exercises requiring practice and revision of expository writing are included. Appropriate use of primary references and the dangers of secondary referencing will be described. 1.5 credits. *Issitt and Reisner*

**TM-250. Education.** This course will explain the fundamentals and principles of planning and implementing an educational program. The need for establishing course goals and objectives and the means of ensuring at the planning stage, that each will be met during the actual teaching, will be emphasized. Various mechanisms for course evaluation will be taught so that students will be able to determine the success of the program in attaining goals and objectives. Teaching in the clinical setting will be emphasized and each student will complete a supervised project. 1.5 credits. *Wells*

**TM-260. Management and Supervision.** This course will be presented by Business School faculty and Medical Center faculty and staff to prepare the laboratory medicine practitioner to manage operational and fiscal laboratory affairs. Principles and techniques of budgeting, staffing, leasing, negotiating, and supervising will be presented in lecture and participatory exercise formats. 1.5 credits. *Business school faculty and Medical Center faculty/staff*

**TM-270. Blood Group Systems, II.** Continuation of TM-220 which is a prerequisite for enrollment in TM-270. Describes the Rh, Kell, Duffy, Kidd, MN, Ss and Lutheran blood group systems from historical, genetic, immunological, serological, biochemical and clinical perspectives including disease associations. Describes how unusual deletions or suppressor genes can affect phenotypes and how phenotypes can be used to recognize haplotypes. 2 credits. *Issitt*

**TM-275. Blood Group Systems, III.** Continuation of TM-220 and TM-270 which are prerequisites for enrollment in TM-275. Describes the Gerbich, Colton, Dombrock, Cartwright, Scianna, Xg, Diego, Indian, Sd, Cad, Bg, Chido, Rodgers, Cromer, Knops and Er blood group systems and genetically independent antigens of high and low incidence from historical, genetic, immunological, serological, biochemical and clinical perspectives including disease associations. Describes how unusual deletions or suppressor genes can affect phenotypes and how phenotypes can be used to recognize haplotypes. 2 credits. *Issitt*

**TM-280. Clinical Practicum.** Supervised clinical rotations in compatibility testing, immunohematology, HLA, parentage testing, molecular biology, donor selection and processing. Preparation, storage, and shipment of blood products, quality assurance, and record keeping are described. Emphasis is placed on the most effective functioning and direction (supervision) of the laboratory or division, and resolution of both repetitive and unusual problems which will vary by department. At the end of each rotation, the student will be capable of directing the laboratory area in a manner ensuring maximal safety and efficacy of patient care. 6 credits. *Staff*

**TM-285. Immunohematological Disorders.** Describes the role of blood group antigens and antibodies in a series of disorders in which immunohematological findings are diagnostic. Based on all known human blood group systems so that TM-220, TM-270 and TM-275 are prerequisites for enrollment in TM-285. Topics covered are: antibody detection and identification; differentiation between clinically significant and insignificant antibodies; compatibility testing; red cell phenotyping; use of ultra-sensitive methods for in vitro tests; in vivo red cell survival studies; polyagglutination; transfusion reactions; hemolytic disease of the newborn; autoimmunity; cold hemagglutinin disease; paroxysmal cold hemoglobinuria; warm antibody-induced hemolytic anemia; drug-induced antibodies and hemolytic anemia. 2 credits. *Issitt*

**TM-371. Thesis Research.** Design of a project that may deal with a scientific, technical, managerial, or educational topic concerning transfusion medicine; initial planning phase is to be under the direction of a faculty member. As the project develops and data accumulate, the student will work independently, to finish the research and to write a thesis by the end of the course. The student will be expected to defend the thesis in an oral examination before selected faculty members, including the project mentor who will serve as chair of the examination committee. 7 credits. *Issitt, Reisner, Telen, Bredehoeft or other selected faculty mentor*

## Graduate School Program

The Graduate School of Duke University awards a Master of Science degree to students who complete the program in physical therapy. Physical therapy is a department in the Graduate School and additional information, including courses of instruc-



tion, may be found in the Graduate School bulletin which is available through the Office of Admissions, Graduate School, Duke University, Durham, North Carolina 27706. Graduate programs are also integral parts of Duke University Medical Center.

## PHYSICAL THERAPY

Professor: Robert C. Bartlett, M.A., *Chairman*

Associate Professors: Margaret Schenkman, Ph.D.; Elia E. Villanueva, M.A.

Assistant Professor: Jan Gwyer, Ph.D., *Director of Graduate Studies*

Assistant Clinical Professors: Carol C. Figuers, M.S.; Mary Ellen Riordan, M.S.; Julie M. Chandler, M.S.

Clinical Associates: Linda M. Lawrence, M.S.; Elizabeth Ross, M.S.

Adjunct Associates: Dennis Bongiorno, B.S.; Susan E. Harryman, M.S.; Martha Propst, M.A.; Wadsworth D. Roy III, B.S.; Keith E. Varvel, M.P.H.

Emeriti: Eleanor Branch, Ph.D.; Grace Horton, B.S.

The Duke University Graduate Program in Physical Therapy, leading to the Master of Science degree, is a program for entry into the profession of physical therapy. The program is designed to provide a comprehensive foundation in the art and science of physical therapy, preparing individuals for clinical practice. Experiences in the areas of administration and research are also provided.

**Program of Study.** The fully accredited program of study requires fifty-two credit units of graduate course work, research, clinical affiliation, or other equivalent academic experience, and is twenty-two consecutive months in length. Forty to forty-two units of work must be in physical therapy, seven units in designated courses in biological anthropology and anatomy, and neurobiology, and the remaining three to five units in electives in related fields. A research project is required which provides the opportunity to pursue a particular aspect of physical therapy in-depth.

**Prerequisites for Admission.** Requirements for admission to the physical therapy program include a baccalaureate degree, completion of prerequisite courses, Graduate Record Examination (GRE) Aptitude Test scores, the filing of an application, and, upon invitation, a personal interview. It is strongly recommended that the GRE be taken no later than the October test date. Consult Graduate School application for deadline by which the application and all supportive documents must be received by the Graduate School Office of Admission. Only completed applications are forwarded to the Graduate Program in Physical Therapy. No application forms are mailed after 3 December. Only students for full-time study are accepted. State of residency does not influence admission policies or tuition costs. Requests for applications and further information should be directed to the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710, telephone 919/684-3135.

**Tuition and Expenses.** The 1994-95 academic year tuition for students enrolled in the Graduate Program in Physical Therapy is \$455 per credit unit. Estimated cost for the two-year program is approximately \$42,000, including tuition and living expenses.

**Financial Aid.** All students are encouraged individually to seek sources of financial assistance. Loan money may be available through the Duke University Medical Center. Financial aid applications are mailed to students after acceptance into the program. Please refer to the section on student aid in the chapter, "The Allied Health Programs." Physical therapy students are not eligible for fellowships, assistantships and traineeships offered by the Graduate School.



## Certificate Programs

Duke University Medical Center has responded to the increased need for qualified individuals at all levels in the health care system by developing educational programs designed to equip people for a variety of positions. These programs, which vary in admission requirements and length of training, offer students both clinical and didactic experience. Graduates of these programs are awarded certificates.

### Clinical Psychology Internship

Director of Clinical Training: W. Derek Shows, Ph.D.

The Division of Medical Psychology, Department of Psychiatry, Duke University Medical Center, offers internship training in clinical psychology to students who are currently enrolled in APA-approved Ph.D. programs in clinical psychology and who have already completed three years of graduate study. The program, approved by the American Psychological Association, provides experience in many contexts with a wide diversity of patients. Internship training provides experience in the traditional activities of clinical psychologists: assessment, consultation, treatment, and research. Those successfully completing the requirements for internship will be awarded a Duke University Medical Center certificate. Requests for additional information and correspondence concerning admission to the program should be directed to the Director, Clinical Psychology Internship Program, Box 3362, Duke University Medical Center, Durham, North Carolina 27710.

### Clinical Pharmacy Practice Residency

Director, Clinical Pharmacy Residency: Christine Rudd, Pharm.D., F.C.C.P.

Director of Pharmacy Services: James C. McAllister, M.S.

Clinical Pharmacy Practice Residency is a twelve-month postgraduate program conducted by the Department of Pharmacy at the Duke University Medical Center. The residency is designed to give the graduate pharmacist extensive training in clinical pharmacy practice.

**Admission Standards.** Applicants must be graduates of accredited schools of pharmacy and must have a Pharm.D. degree. Residency candidates must demonstrate superior academic and leadership capabilities and be eligible for licensure in North Carolina. It is preferable that the applicant have previous hospital pharmacy experience.

**Application Procedures.** Applications must be submitted by early January of the year for which admission is requested and include the following:

1. ASHP resident matching program application code number;
2. official transcript from pharmacy school and other professional programs attended;
3. completed residency application forms; and
4. letters of recommendation from at least three persons who have known the applicant professionally (e.g., pharmacy school professor, hospital pharmacist, clinical pharmacist).

Applicants will be notified by 30 March regarding admission to the program. Requests for further information and application forms should be directed to the Director for Residency Training, Box 3089, Duke University Medical Center, Durham, North Carolina 27710.

**Stipend.** A stipend of \$28,000 is granted for the twelve-month residency.

## Clinical Laboratory Science (Medical Technology)

Professor of Pathology: Salvatore V. Pizzo, M.D., Ph.D., *Chairman, Department of Pathology and Director of Clinical Laboratories*

Associate Professor of Pathology: Frances K. Widmann, M.D., *Medical Director, Clinical Laboratory Science Program*

Assistant Clinical Professor of Pathology: Margaret C. Schmidt, Ed.D., MT(ASCP)SH, CLS(NCA), CLSpH(NCA), *Program Director, Clinical Laboratory Science Program*

Assistant Clinical Professor of Pathology: Cynthia L. Wells, Ed.D., MT(ASCP), CLS(NCA), *Assistant Program Director, Clinical Laboratory Science Program*

Medical Center Instructors in Pathology, Clinical Laboratory Science Program: Linda L. Seefried, M.A., MT(ASCP), CLSup(NCA); Barbara L. Burton, B.S., CLS/C(NCA), C(ASCP); Mary Ann Dotson, B.S., MT(ASCP), CLS(NCA); Patty Hanneman, M.S., MT(ASCP)SBB; Leslie W. Bard, B.S., MT(ASCP), CLS(NCA).

Associate Professors: Emily Reisner, Ph.D.; John Toffaletti, Ph.D.; Peter Zwadyk, Ph.D.

Assistant Professors: John A. Bittikofer, Ph.D.; Steven Bredehoeft, M.D.

Medical Research Associate: Lizzie Harrell, Ph.D.

Clinical Teaching Staff: Billy H. Abrams, B.A., MT(ASCP); Marilyn Alexieff, B.A., MT(ASCP); Yolanda Bell, B.S., MT(ASCP); Mark Christy, B.A., M.H.S., CLS(NCA); Adella Clark, B.S., MT(ASCP); Martha Rae Combs, B.S., MT(ASCP)SBB; Betty R. Crews, B.S., MT(ASCP); Gary Cudak, B.S., MT(ASCP); Brenda Deal, B.S., MT(ASCP); Lynn Ferlisi, B.S., MT(ASCP); Todd A. Hitch, B.S., MT(ASCP); Cathy Holleman, M.S., MT(ASCP)SC; Kelly Joyner, MT(ASCP)SH; Freda Kohan, B.S., MT(ASCP)SM; Janet Mueller, B.S., MT(ASCP); Beverly S. Oxford, B.S., MT(ASCP)SC; Ann Padgett, B.H.S., MT(ASCP)SM; Ruth Parrish, CLPib(NCA); Norma Sabiston, B.S., MT(ASCP); Suzanne Schrack, MT(ASCP); Sara Sparks, B.S., MT(ASCP); Rena Tarlton, B.S. (MT(ASCP); Claudine Zimmerman, B.S. MT(AMT).

Affiliate Institution Advisors: Robert K. Reid, Ph.D., *Meredith College*; Marsha E. Fanning, Ph.D., *Lenoir-Rhyne College*; Derek Barkelow, Ph.D., *Stetson University*; George Barthalmus, Ph.D., *North Carolina State University*; Steven Chalgren, Ph.D., *Radford University*; Karen E. Otto, Ph.D., *University of Tampa*; J. S. Waterhouse, Ph.D., *State University of New York at Plattsburgh*; Neal Summerlin, Ph.D., *Lynchburg College*; Wilbur C. Jones, Ph.D., *Concord College*; James W. Small, Ph.D., *Rollins College*; Richard Heller, Ph.D., *Albright College*; Anne Kendrick, M.S., MT(ASCP), *University of North Carolina at Wilmington*; Craig Allee, Ph.D., *Shorter College*; David Tate, Ph.D., *Purdue University*; Pinapaka Murthy, Ph.D. *Fayetteville State University*.

**Program of Study.** The educational program begins 1 June and consists of fifty-four instructional weeks which includes three weeks of vacation. The first four weeks consist of a core curriculum of courses offered to all students at the same time. After successful completion of the core curriculum, the student is eligible to begin forty weeks of coordinated coursework and clinical rotations in blocks of ten weeks each. After completion of the four major course and rotation blocks, a six-week term is devoted to a course of study in educational techniques, management and supervision, and quality assurance in health care. Lectures, student laboratory experience, and clinical laboratory instruction are presented by a faculty and staff of clinical laboratory scientists, physicians, chemists, and microbiologists.

Graduates of this NAACLS-accredited program are eligible for national certification as a clinical laboratory scientist. Career opportunities in hospital laboratories, research, public health facilities, and educational institutions are available. This program is formally affiliated with Meredith College, Raleigh, North Carolina; Lenoir-Rhyne College, Hickory, North Carolina; the University of Tampa, Tampa, Florida; Stetson University, Deland, Florida; North Carolina State University, Raleigh, North Carolina; Radford University, Radford, Virginia; State University of New York at Plattsburgh, Plattsburgh, New York; Lynchburg College, Lynchburg, Virginia; Concord College, Athens, West Virginia; University of North Carolina at Wilmington, Wilmington, North Carolina; and Shorter College, Rome Georgia, and Purdue University, West Lafayette, Indiana, and Fayetteville State University, Fayetteville, North Carolina, to provide the 3+1 study format toward a degree from these institutions. A cooperative agreement exists with Rollins College, Winter Park, Florida, and Albright College, Reading, Pennsylvania to channel 4+1 students to this program.

**Prerequisites for Admission.** Applicants to the program must possess the following academic prerequisites:



1. Possession of a baccalaureate degree, OR the completion of at least three years of study in an accredited college or university which totals ninety semester hours (120 quarter hours) with grades of C or better, and the written guarantee that a baccalaureate degree will be conferred by a university after successful completion of this program.
2. Four courses in major-track chemistry (including at least one course in organic chemistry).
3. Four courses in major-track biology (including one course in microbiology).
4. One course of college level mathematics.

**Application Procedures.** A completed application file contains the following:

1. The completed Duke University Medical Center Allied Health application form, including a nonrefundable processing fee;
2. Official transcript(s) from all colleges and universities attended;
3. Three letters of recommendation, one from a professor of biological sciences, one from a professor of chemistry, and one from a college advisor;
4. A personal interview with members of the Admissions Committee, if requested, following the receipt of the application and other information;
5. A written statement of interest in clinical laboratory science;
6. Evaluation of transcript credits earned outside the U. S. A., if requested.

The deadline for applications is 1 April of the year for which admission is requested. It is strongly recommended that applications be submitted by 15 December to receive timely consideration. Applications received after 15 December will be considered on a space-available basis. Applicants will be notified no later than 1 May regarding admission to the program. Requests for further information and application forms should be directed to the Clinical Laboratory Science Program Admissions, Box 2929, Education Service, Department of Pathology/Clinical Laboratories, Duke University Medical Center, Durham, North Carolina 27710.

**Fees and Expenses.** Tuition for the program is \$2,625\*. A lab fee is charged for student labs. The student is responsible for housing, board, uniforms, books, and student health fee and medical insurance.

A nonrefundable deposit of \$175 is required of all accepted candidates to hold their place in the class. This deposit applies toward the tuition fee. The remaining tuition and fee balance is billed in two increments; at matriculation and in January (mid-year).

**Transportation Required.** The use of facilities other than Duke and Durham Veterans Administration Medical Centers requires transportation. It is the responsibility of each clinical laboratory science student to provide a means of transportation to and from the facilities selected for learning experiences. Although a few sites may be within bicycling distance, most are not.

**Financial Aid.** Please refer to the section on student aid in the chapter, "The Allied Health Programs".

**Part-time Employment.** Students who wish to work are eligible to compete for available part-time paid positions within hospital laboratories AFTER successful completion of the core curriculum and one major course and rotation block. Such positions are not to exceed a maximum of 19.9 hours per week.

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\*Subject to change without prior notice.



**Certification Examinations.** Graduates of this program are eligible to sit for the national agency sponsored certification exam of their choice. Application forms and procedures will be provided and explained as a service to enrolled students during the clinical year of education. Consistent with Medical School Policy, this program considers certification to be the responsibility of the individual. This curriculum is not directed to prepare students specifically for certification examinations; however, satisfactory performance in this program should provide sufficient information and experience to pass a certification exam. The Program Certificate is not dependent upon passing a certification exam.

**Courses of Instruction.** Students must complete the following courses:

#### **Core Curriculum\***

<i>Course Title</i>	<i>Clock Hours</i> <i>Lect/Lab/Rotation</i>
Orientation Activities	50/00/00
CLS-103. Phlebotomy Principles and Procedures	10/00/40
CLS-107. Basic Principles of Immunology	35/00/00

#### **Course and Rotational Blocks**

<i>Course Title</i>	<i>Clock Hours</i> <i>Lect/Lab/Rotation</i>
CLS- 101. Issues in Clinical Laboratory Science	32/00/000
CLS-112. Biochemical Measurements and Disorders	140/84/200
CLS-120. Immunohematology	114/66/200
CLS-121. Blood and Body Fluids	80/115/160
CLS-132. Medical Microbiology/Serology	92/77/192

#### **Program Final Term**

<i>Course Title</i>	<i>Clock Hours</i> <i>Lect/Lab/Rotation</i>
CLS-113. Quality Assurance in Health Care	25/00/00
CLS-114. Elective/Alternate Site Rotation	00/00/40
CLS-124. Educational Techniques for the Health Professional	18/06/00
CLS-126. Laboratory Supervision and Management	26/00/00

### **Ophthalmic Medical Technician**

Professor: W. Banks Anderson, M.D., *Medical Director*

Associate Professor: Judy H. Seaber, Ph.D., *Program Director*

Teaching Staff: Lois Duncan, CO, COMT; Barbara Suitt, R.N., COT, *Clinical Coordinators*

The ophthalmic medical technician program is sponsored by the Department of Ophthalmology, Duke University Medical Center. This is a one-year certificate course designed to prepare the student to perform adequately as an ophthalmic medical technician. The program consists of didactic lectures designed to provide the basic clinical background necessary for the student to understand and perform the technical tasks designated to them by an ophthalmologist. The educational program begins 1 July, and consists of forty-nine weeks of instruction with three weeks of vacation. The core curriculum will be covered within the first six months supplemented by clinical experience under close supervision of clinical support staff and faculty. The second half of the program will consist of clinical rotations with the student working under the close

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\*Course work in the core curriculum must be successfully completed to gain access to the courses which follow.

supervision of qualified clinical support staff and faculty and evaluated on a routine basis as their skills develop.

Upon satisfactory completion of the course, students will receive certification from Duke University Medical Center and are eligible to sit for national certification examination by the Joint Commission of Allied Health Personnel in Ophthalmology at the level of ophthalmic medical technician.

**Prerequisites for Admission.** Applicants to the program must have two years of college or the equivalent.\* Priority will be given to students with a college degree or extensive work experience in some field of ophthalmology.

**Application Procedures.** Applications must be received by 1 May of the year for which admission is requested and must contain the following:

1. the completed Duke University Medical Center Allied Health application form, including a nonrefundable processing fee;
2. official transcript(s) from all colleges and universities attended;
3. three letters of recommendation;
4. a personal interview with members of the admissions committee may be requested following receipt of the application and other information.

The deadline for applications is 1 May of the year for which admission is requested. It is strongly recommended that applications be submitted as early as possible. Applicants will be notified no later than 1 June regarding admission to the program. Requests for further information and application forms should be directed to the Program Director, Judy H. Seaber, Ph.D., Box 3802, Duke University Eye Center, Durham, North Carolina 27710.

**Fees and Expenses.** Tuition for the program is \$2,800. The student is responsible for housing, board, books, the student health fee and medical insurance. Fifty percent of the tuition is due at matriculation with the balance being due in January.

**Transportation Required.** It may be necessary for students to rotate at clinical sites other than at Duke University Medical Center and transportation may be necessary. It is the responsibility of the student to provide a means of transportation to and from the facility selected for learning experiences.

**Financial Aid.** Please refer to the section on student aid in the chapter, The Allied Health Programs.

**Courses of Instruction.** Students must satisfactorily complete the following courses. The curriculum will include but will not be limited to the following:

COURSE TITLE	CLOCK HOURS
Basic Science Lecture	150
Visual Acuity Assessment	10
Physiology and Anatomy of the Eye	10
Physical History	10
Cardiopulmonary Resuscitation	8
Instrument Maintenance	5
Visual Fields	40
Optics	40
Medical Terminology	15
Spectacles	10
Pharmacology	5

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\*Decided by the admissions committee on an individual basis.

Glaucoma and Tonometry	16
External Diseases	8
Physiology of Systemic Diseases	12
Contact Lens	14
Ocular Motility	15
Neurology	5
General Psychology	5
Practicums, Clinical I, II, III, IV, V	TBA
TOTAL	378

## Pastoral Care and Counseling

Associates in Instruction: Claude V. Deal, M.Div.; Margot K. Hover, D.Min.; M. Susan Nance, Th.M.; James A. Rawlings, Jr., M.Div.; James L. Travis, Ph.D.

A graduate program in pastoral care and counseling is available to clergy, theological students, members of religious orders and lay persons of all religious faith groups. There are three levels of training and five distinct program structures of Clinical Pastoral Education offered at Duke University Medical Center. All programs are designed to train individuals who desire to specialize in pastoral care, to enhance their skills as parish clergy, or to broaden their understanding of ministry. With the exception of the Parish-Based Extended Basic CPE Program, all who enroll in any of the programs of Clinical Pastoral Education will be required to serve as chaplains in the Medical Center. All programs are accredited by the Association for Clinical Pastoral Education, Inc.

**Programs of Study.** The three training levels of Clinical Pastoral Education are basic, advanced, and supervisory. There are three distinct program structures of basic CPE including the summer fulltime basic CPE program (June-August), the hospital-based extended basic CPE program, and the parish-based extended basic CPE program. Extended basic CPE units are offered concurrently with the fall and spring semesters of Duke Divinity School. The fourth program structure is the year-long residency program, which begins in June and extends through the following May (four consecutive units). In the residency program, one may be at either a basic or advanced level of training. The fifth program structure is the supervisory CPE program for those seeking to be certified as a clinical pastoral education supervisor.

Requests for application and further information about any of the programs should be directed to the Director, Pastoral Services, Box 3112, Duke University Medical Center, Durham, North Carolina 27710. Admission procedures to each program include:

1. completion and submission of written application materials;
2. an admission interview by a qualified interviewer;
3. acceptance by the Duke University Medical Center CPE Center.

In addition to the above admission procedures, requirements for admission to specific CPE programs include:

1. Graduation from college and seminary-equivalences may be considered; and adequate ministry formation/development and experience in ministry which indicates readiness for this program (Residency CPE Program).
2. Ecclesiastical endorsement; pastoral experience of usually not less than three years; completion of program objectives of basic and advanced CPE; and consultation by the appropriate committee in the region with respect to his/her readiness to pursue supervisory training (Supervisory CPE).
3. Completion of a consultation process between a Duke University Medical Center CPE supervisor and a church board (Parish-Based Extended Basic CPE).
4. A personal interview with Duke University Medical Center faculty (residency and supervisory CPE).



5. Submission of previous basic CPE unit(s) final evaluation by student and supervisor(s) (residency and supervisory CPE).

**Salary and Fees.** Stipends are available for students in the residency program and the supervisory CPE program. For 1994-95, the salary for the residency program is \$17,500, and for the supervisory CPE program the salary is \$20,750. There is no salary available for summer fulltime and extended basic CPE units. Salaried students are eligible for the same benefit package as Duke University employees of comparable levels.

Tuition is \$375 per unit when enrolled through the Allied Health Division of Duke University Medical Center (\$325 for two or more consecutive units), and \$2,000 per unit when enrolled through Duke University Divinity School for academic credit. (A unit of CPE equals two academic courses.)

Fees include the following:

1. Application fee of \$30 must accompany an Allied Health form, unless applying with intention of enrolling through Duke University Divinity School.
2. \$55 per unit for Mid-Atlantic Region fee.
3. \$40 for admission interviews when requested.
4. \$100 tuition deposit for those accepted into the year-long residency program.
5. \$50 tuition deposit for students accepted into the summer fulltime and extended basic CPE programs.



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*Graduate School*

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*The Bulletin of Duke University*, Volume 67, includes the following titles: *The Fuqua School of Business*; *The School of the Environment*; *Undergraduate Instruction*; *The Graduate School*; *The Medical Center*; *The Divinity School*; *Information for Prospective Students*; *Information for Graduate Students*; *Summer Session*; *Graduate Program in Nursing*; *The School of Law*; and *Information and Regulations*.

Information that the University is required to make available under the Student Right to Know and Campus Security Acts may be obtained from the Office of University Relations at 684-2823 or in writing at 615 Chapel Drive, Duke University, Durham, North Carolina 27706.

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# Calendar of the Graduate School\*

## Summer 1995†

<b>May</b>		
18	Thursday	—Summer Session Term I classes begin.
<b>June</b>		
28	Wednesday	—Summer Session Term I final examinations begin.
29	Thursday	—Summer Session Term I final examinations end.
<b>July</b>		
3	Monday	—Summer Session Term II classes begin.
<b>August</b>		
1	Tuesday	—Final date to submit master's theses and Ph.D. dissertations for a September degree.
11	Friday	—Summer Session Term II final examinations begin.
11	Friday	—Final date for completing degree requirements for an advanced degree to be awarded September 1995. All final copies of examined and signed theses and dissertations must be returned to 013 Perkins Library by this date.
12	Saturday	—Term II final examinations end.
17-26		Oral proficiency interviews for all incoming students whose native language is not English. Details available through International House.

## Fall 1995

<b>August</b>		
25	Friday	—Graduate and Professional School Opening Convocation, 5:00 p.m., Duke Chapel.
26	Saturday	—English examination required for all incoming students whose native language is not English. Examination will begin in Room 139, Social Sciences Building, at 10:00 a.m.
28	Monday	—Fall semester classes begin at 8:00 a.m.
<b>September</b>		
8	Friday	—Last day for drop/add. No late registrations will be taken after this date.
<b>October</b>		
13	Friday	—Fall break begins at 7:00 p.m.
18	Wednesday	—Classes resume at 8:00 a.m.
<b>November</b>		
1	Wednesday	—Last day for completion of applications to the spring 1996 semester.
22	Wednesday	—Thanksgiving recess begins at 12:40 p.m.
27	Monday	—Classes resume at 8:00 a.m.
<b>December</b>		
1	Friday	—Final date for filing with the Graduate School the intention to receive an advanced degree in December 1995.
1	Friday	—Deadline for applications eligible to pay reduced application fee (see application materials), fall 1996.
1	Friday	—Graduate classes end at 7:00 p.m.
6	Wednesday	—Final date to submit master's theses and Ph.D. dissertations.
2-10	Saturday-Sunday	—Graduate reading period; length of 200-level course reading period is determined by the instructor.
10	Sunday	—Founders' Day.
11	Monday	—Final examinations begin.

\*The dates in this calendar are subject to change. Information on registration dates is available from the Office of the University Registrar.

†The School of the Environment, the Fuqua School of Business, the Marine Laboratory, and the Department of Physical Therapy have different term lengths and/or starting dates during the summer; consult the appropriate bulletins and schedules.

**December (cont.)**

- 15 Friday—Final date for completing degree requirements for an advanced degree to be awarded December 1995. All final copies of examined and signed theses and dissertations must be returned to 013 Perkins Library by this date.
- 16 Saturday—Final examinations end.
- 31 Sunday—Postmark deadline for applications to all programs (see application materials), fall 1996. Note: Where post offices are closed on Sunday, the postmark deadline will be Saturday, December 30.

**Spring 1996****January**

- 6 Saturday—English language proficiency examination for all incoming students whose native language is not English from 10:00 a.m.-12:00 noon in Room 317 Allen Building.
- 11 Thursday—Spring semester classes begin at 8:00 a.m.
- 24 Wednesday—Final day for drop/add. No late registrations will be allowed after January 24.

**February**

- 1 Thursday—Final date for filing with the Graduate School office the intention to receive an advanced degree in May.

**March**

- 8 Friday—Spring recess begins at 7:00 p.m.
- 18 Monday—Classes resume at 8:00 a.m.

**April**

- 1 Monday—Final date for submitting for approval dissertation for the Ph.D. degree.
- 15 Monday—Final date for submitting for approval theses for master's degrees.
- 19 Friday—Graduate classes end at 7:00 p.m.
- 20-28 Saturday-Sunday—Graduate reading period; length of 200-level course reading period is determined by the instructor.
- 26 Friday—Final day for completing degree requirements for an advanced degree to be awarded in May 1996. All final copies of examined and signed theses and dissertations must be returned to 013 Perkins by this date.
- 29 Monday—Final examinations begin.

**May**

- 4 Saturday—Final examinations end.
- 10 Friday—Commencement begins.
- 12 Sunday—Graduation exercises. Conferring of degrees.



# University Administration

## GENERAL ADMINISTRATION

Nannerl Overholser Keohane, Ph.D., *President*  
John W. Strohbehn, Ph.D., *Provost*  
Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean, School of Medicine*  
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Gordon G. Hammes, Ph.D., *Vice-Chancellor for Medical Center Academic Affairs*  
Mark C. Rogers, M.D., *Vice-Chancellor for Health Services and Executive Director of Duke University Hospital*  
R. C. Bucky Waters, B.S., M.A., *Vice-Chancellor for Special Projects, Duke University Medical Center*  
David B. Adcock, J.D., *University Counsel*  
N. Allison Haltom, A.B., *Secretary of the University*  
William H. Willimon, M.Div., S.T.D., *Dean of the Chapel*

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A. Leigh DeNeef, Ph.D., *Associate Dean*  
Donna Lee Giles, A.B., *Assistant Dean*  
Katharine Pfeiffer, M.A., *Assistant Dean*  
Aleane G. Webb, *Assistant Dean*

## EXECUTIVE COMMITTEE OF THE GRADUATE FACULTY

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Leigh DeNeef, *Associate Dean*  
William Ascher  
Elizabeth Clark  
John Coie  
Thomas DiPrete  
Owen Flanagan  
Michael Gillespie  
Michael Lavine  
Melvyn Lieberman  
Walter Mignolo  
Loren Nolte  
Stephen Nowicki  
Jeffrey Peirce  
Ned Porter  
John Richards  
Boyd Strain  
Robert Webster

## Graduate School Faculty

*(As of January 1, 1995.)*

*The date denotes the first year of service at Duke University.*

Stanley Kenji Abe (1994), Ph.D., *Assistant Professor of Art and Art History*  
Mohamed Bahie Abou-Donia (1975), Ph.D., *Professor of Pharmacology and Professor of Neurobiology*  
Dolph O. Adams (1972), M.D., Ph.D., *Professor of Pathology and Associate Professor of Immunology*  
Pankaj K. Agarwal (1990), Ph.D., *Associate Professor of Computer Science*  
Peter Aitken (1988), Ph.D., *Associate Medical Professor of Cell Biology*  
John H. Aldrich (1987), Ph.D., *Professor of Political Science*  
Dimitri Alexandrou (1987), Ph.D., *Associate Professor of Electrical Engineering*  
William K. Allard (1975), Ph.D., *Professor of Mathematics*  
Anne Allison (1992), Ph.D., *Assistant Professor of Cultural Anthropology*  
A. Tito Alt (1961-65; 1967), Ph.D., *Professor of Germanic Languages and Literature*  
Nels C. Anderson (1966), Ph.D., *Associate Professor of Cell Biology*  
Norman B. Anderson (1985), Ph.D., *Associate Professor of Psychology: Social and Health Sciences*

Page A. W. Anderson (1973), M.D., Assistant Professor of Cell Biology  
 Edna Andrews (1984), Ph.D., Associate Professor of Slavic Languages and Literatures  
 James J. Anton (1989), Ph.D. Associate Professor of Business Administration  
 Janis Antonovics (1970), Ph.D., James J. Wolfe Professor of Botany  
 James W. Applewhite (1971), Ph.D., Professor of English  
 Mahadev L. Apte (1965), Ph.D., Professor of Cultural Anthropology  
 Ronald Paul Archer (1990), Ph.D., Assistant Professor of Political Science  
 Gustavo Arcia (1994), Adjunct Associate Professor of Public Policy Studies  
 Yair Argon (1984), Ph.D., Assistant Professor of Immunology and Assistant Professor of Cell Biology  
 William Louis Ascher (1984), Ph.D., Professor of Public Policy Studies and Professor of Political Science  
 Alison Hubbard Ashton (1986), Ph.D., Associate Professor of Business Administration  
 Robert H. Ashton (1986), Ph.D. T. Austin Finch, Sr., Professor of Business Administration  
 George J. Augustine (1991), Ph.D., Associate Professor of Neurobiology  
 Lloyd Richard Bailey (1971), Ph.D., Professor of Religion, Old Testament  
 Paul A. Baker (1981), Ph.D., Professor of Geology  
 Andrew E. Balber (1985), Ph.D., Associate Medical Research Professor of Immunology  
 Steven W. Baldwin (1978), Ph.D., Professor of Chemistry  
 Helmy Hamdollah Baligh (1967), Ph.D., Professor of Business Administration  
 Robert H. Ballantyne (1962), Ed.D., Associate Professor of Education  
 Ravi Bansal (1990), Ph.D., Associate Professor of Business Administration and Adjunct Assistant Professor of Economics  
 James David Barber (1972), Ph.D., James B. Duke Professor of Political Science and Professor of Public Policy Studies  
 Richard T. Barber (1980), Ph.D., Harvey W. Smith Professor of Biological Oceanography  
 Roger C. Barr (1969), Ph.D., Professor of Biomedical Engineering  
 Elizabeth C. Bartlet (1982), Ph.D., Associate Professor of Music  
 Robert Charles Bartlett (1976), M.A., Professor of Physical Therapy  
 Jorge Valls Bartolome (1978), Ph.D., Associate Medical Research Professor of Pharmacology  
 Deepak Bastia (1979), Ph.D., Professor of Microbiology  
 J. Thomas Beale (1983), Ph.D., Professor of Mathematics  
 Hie Ping Beall (1975), Ph.D., Assistant Research Professor of Mechanical Engineering and Materials Science  
 Michael Been (1987), Ph.D., Associate Professor of Biochemistry  
 Lorena Beese (1992), Ph.D., Assistant Professor of Biochemistry  
 Robert D. Behn (1973), Ph.D., Professor of Public Policy Studies  
 Robert Paul Behringer (1982), Ph.D., James B. Duke Professor of Physics, Professor of Computer Science, and Professor of Mechanical Engineering and Materials Science  
 Adrian Bejan (1984), Ph.D., J. A. Jones Professor of Mechanical Engineering and Materials Science  
 David F. Bell III (1983), Ph.D., Associate Professor of Romance Studies  
 Robert M. Bell (1972), Ph.D., Professor of Molecular Cancer Biology and James B. Duke Professor of Biochemistry  
 Messod Beneish (1989), Ph.D., Associate Professor of Business Administration  
 Bruce A. Benjamin (1989), Ph.D., Assistant Professor of Cell Biology  
 Peter Brian Bennett (1972), Ph.D., D.Sc., Professor of Cell Biology  
 Vann Bennett (1987), Ph.D., Professor of Biochemistry and Professor of Cell Biology  
 Teresa Berger (1987), Ph.D., Assistant Professor of Religion, Ecumenical Theology  
 Donald A. Berry (1990), Ph.D., Professor of Statistics and Decision Sciences  
 James R. Bettman (1982), Ph.D., Burlington Industries Professor of Business Administration, Professor of Psychology: Experimental, and Professor of Psychology: Social and Health Sciences  
 William T. Bianco (1987), Ph.D., Assistant Professor of Political Science  
 Alan Biermann (1974), Ph.D., Professor of Computer Science  
 Darell D. Bigner (1972), M.D., Ph.D., Professor of Pathology  
 Sandra H. Bigner (1977), M.D., Professor of Pathology  
 Edward George Bilpuch (1962), Ph.D., Professor of Physics  
 Minmay Biswas (1983), Ph.D., Associate Research Professor of Civil Engineering  
 Perry J. Blackshear (1984), M.D., Ph.D., Professor of Biochemistry  
 Kalman P. Bland (1973), Ph.D., Associate Professor of Religion  
 Donald B. Bliss (1985), Ph.D., Associate Professor of Mechanical Engineering and Materials Science  
 Jacob J. Blum (1962), Ph.D., James B. Duke Professor of Cell Biology  
 James A. Blumenthal (1979), Ph.D., Associate Professor of Psychology: Social and Health Sciences  
 Fred K. Boadu (1994), Ph.D., Assistant Professor of Civil Engineering  
 John A. Board, Jr. (1986), Ph.D., Associate Professor of Electrical Engineering and Assistant Professor of Computer Science  
 Mary T. Boatwright (1979), Ph.D., Associate Professor of Classical Studies  
 Dani P. Bolognesi (1971), Ph.D., Professor of Microbiology  
 Celia Bonaventura (1972), Ph.D., Professor of Environment and Professor of Cell Biology  
 Joseph Bonaventura (1972), Ph.D., Professor of Environment and Professor of Cell Biology  
 James F. Bonk (1959), Ph.D., Professor of Chemistry  
 Frank Borchardt (1971), Ph.D., Professor of Germanic Languages and Literature  
 Edward H. Bossen (1972), M.D., Professor of Pathology  
 Laura J. Bottomley (1992), Ph.D., Research Assistant Professor of Electrical Engineering



Alan E. Boudreau (1988), Ph.D., Assistant Professor of Geology  
 Rose-Mary Boustany (1994), Ph.D., Assistant Professor of Neurobiology  
 William F. Boulding (1984), Ph.D., Associate Professor of Business Administration  
 Stephen G. Boyce (1981), Ph.D., Adjunct Professor of Environmental Studies  
 Terry Boychuk (1993), Ph.D., Assistant Professor of Sociology  
 John E. Boynton (1968), Ph.D., Professor of Botany  
 William D. Bradford (1966), M.D., Professor of Pathology  
 Robert N. Brandon (1979), Ph.D., Professor of Philosophy and Professor of Zoology  
 Douglas T. Breeden (1985), Ph.D., Research Professor of Business Administration  
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 Susan E. Brodt (1994), Ph.D., Assistant Professor of Business Administration  
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 Caroline A. Bruzelius (1981), Ph.D., Professor of Art History  
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 C. Edward Buckley, III (1963), M.D., Assistant Professor of Immunology  
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 Edwin Burmeister (1988), Ph.D., Research Professor of Economics  
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 James Crenshaw (1987), Ph.D., *Professor of Religion, Old Testament*  
 Peter Cresswell (1973), Ph.D., *Adjunct Professor of Immunology*  
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 Clifford Cunningham (1993), Ph.D., *Assistant Professor of Zoology*  
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 Calvin D. Davis (1962), Ph.D., *Professor of History*  
 Lucy T. Davis (1969), Ed.D., *Associate Professor of Education*  
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 Dianne DeCamp (1993), Ph.D., *Assistant Professor of Pathology*  
 Francisco Delgado (1990), Ph.D., *Assistant Professor of Business Administration*  
 Arturo De Lozanne (1991), Ph.D., *Assistant Professor of Cell Biology*  
 Neil Barry de Marchi (1971-80; 1983), Ph.D., *Professor of Economics*  
 A. Leigh DeNeef (1969), Ph.D., *Professor of English*  
 Jeffrey H. Derby (1983), Ph.D., *Adjunct Associate Professor of Electrical Engineering*  
 Gerardine DeSanctis (1994), Ph.D., *Professor of Business Administration*  
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 Joseph Di Bona (1967), Ph.D., *Associate Professor of Education*  
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 Thomas A. DiPrete (1988), Ph.D., *Professor of Sociology*  
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 Evgeny Dobrenko (1992), Ph.D., *Associate Professor of Slavic Languages and Literature*  
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 Daniel V. Dore (1985), M.P.A., *Clinical Associate in Physical Therapy*  
 Ariel Dorfman (1988), Ph.D., *Research Professor of Literature and Research Professor of Romance Studies*  
 Earl H. Dowell (1983), Sc.D., J. A. Jones Professor of Mechanical Engineering and Materials Science  
 Carolyn Doyle (1990), Ph.D., *Assistant Professor of Immunology*  
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 Harold P. Erickson (1970), Ph.D., Professor of Cell Biology  
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   *Engineering*  
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   *Neurobiology*  
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 Frans F. Jöbsis (1964), Ph.D., *Professor of Cell Biology*  
 Sheridan Johns III (1970), Ph.D., *Associate Professor of Political Science*  
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 Phillip L. Jones (1977), Ph.D., *Associate Professor of Mechanical Engineering and Materials Science*  
 Lynn Joy (1994), Ph.D., *Professor of Philosophy*  
 Burke Judd (1992), Ph.D., *Adjunct Professor of Genetics*  
 Zbigniew J. Kabala (1994), Ph.D., *Associate Professor of Civil Engineering*  
 William H. Kane (1992), M.D., Ph.D., *Assistant Professor of Pathology*  
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 Ming-Yang Kao (1990), Ph.D., *Assistant Professor of Computer Science*  
 Jeffrey A. Karson (1985), Ph.D., *Professor of Geology*  
 Eric S. Kasischke (1993), Ph.D., *Assistant Research Professor of the Environment*  
 Gabriel G. Katul (1993), Ph.D., *Assistant Professor of the Environment*  
 David Katz (1993), Ph.D., *Professor of Biomedical Engineering*  
 Lawrence C. Katz (1990), Ph.D., *Associate Professor of Neurobiology*  
 Julie A. Kauer (1991), Ph.D., *Assistant Professor of Neurobiology*  
 Bernard Kaufman (1968), Ph.D., *Associate Professor of Biochemistry*  
 Richard F. Kay (1973), Ph.D., *Professor of Biological Anthropology and Anatomy and Professor of Geology*  
 Gershon Kedem (1985), Ph.D., *Associate Professor of Computer Science*  
 Francis J. Keefe (1978), Ph.D., *Associate Professor of Psychology: Social and Health Sciences*  
 Jack D. Keene (1979), Ph.D., *Professor of Microbiology*  
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 Allen C. Kelley (1972), Ph.D., *James B. Duke Professor of Economics*  
 Alexander Keyssar (1986), Ph.D., *Professor of History*  
 Daniel Kiehart (1992), Ph.D., *Associate Professor of Cell Biology*  
 Kent P. Kimbrough (1980), Ph.D., *Professor of Economics*  
 William Kirby-Smith (1990), Ph.D., *Associate Professor of the Environment*  
 Norman Kirshner (1956), Ph.D., *Professor of Pharmacology and Professor of Biochemistry*  
 Joseph Weston Kitchen, Jr. (1962), Ph.D., *Associate Professor of Mathematics*  
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 Kenneth R. Knoerr (1961), Ph.D., *Professor of the Environment and Associate Professor of Botany*  
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 Michael Rod Zalutsky (1985) Ph.D., *Assistant Professor of Pathology*  
 John W. Zarker (1989), Ph.D., *Senior Lecturing Fellow in Classical Studies*  
 Fangyang Zheng (1990), Ph.D., *Assistant Professor of Mathematics*  
 Xin Zhou (1993), Ph.D., *Associate Professor of Mathematics*  
 Peter Zwadyk, Jr. (1971), Ph.D., *Associate Professor of Pathology and Associate Professor of Microbiology*

## Professors Emeriti

Irving E. Alexander (1963), Ph.D., *Professor Emeritus of Psychology*  
 D. Bernard Amos (1962), M.D., *James B. Duke Professor Emeritus of Immunology*  
 Carl L. Anderson (1955), Ph.D., *Professor Emeritus of English*  
 Lewis Edward Anderson (1936), Ph.D., *Professor Emeritus of Botany*  
 Roger Fabian Anderson (1950), Ph.D., *Professor Emeritus of Entomology*  
 Edward M. Arnett (1980), Ph.D., *R. J. Reynolds Professor Emeritus of Chemistry*  
 Kurt W. Back (1959), Ph.D., *James B. Duke Professor Emeritus of Sociology*  
 Joseph Randle Bailey (1946), Ph.D., *Professor Emeritus of Zoology*  
 Frank Baker (1960), Ph.D., *Professor Emeritus of English Church History*  
 M. Margaret Ball (1963), Ph.D., *Professor Emeritus of Political Science*  
 Katharine May Banham (1946), Ph.D., *Associate Professor Emeritus of Psychology*  
 William Waldo Beach (1946), Ph.D., *Professor Emeritus of Christian Ethics*  
 Mary L. C. Bernheim (1930), Ph.D., *Professor Emeritus of Biochemistry*  
 L. C. Biedenharn, Jr. (1961), Ph.D., *James B. Duke Professor Emeritus of Physics*  
 William Dwight Billings (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 John O. Blackburn (1959), Ph.D., *Professor Emeritus of Economics*  
 Cazlyn Green Bookhout (1935), Ph.D., *Professor Emeritus of Zoology*  
 Lloyd J. Borstelmann (1953), Ph.D., *Professor Emeritus of Psychology*  
 Benjamin Boyce (1950), Ph.D., *James B. Duke Professor Emeritus of English*  
 Charles Kilgo Bradsher (1939), Ph.D., *James B. Duke Professor Emeritus of Chemistry*  
 Ralph Braibanti (1953), Ph.D., *James B. Duke Professor Emeritus of Political Science*  
 Eleanor F. Branch (1953), Ph.D., *Associate Professor Emeritus of Physical Therapy*  
 Martin Bronfenbrenner (1971), Ph.D., *William R. Kenan, Jr. Professor Emeritus of Economics*  
 Earl Ivan Brown II (1960), Ph.D., *J. A. Jones Professor Emeritus of Civil Engineering*  
 Louis J. Budd (1952), Ph.D., *James B. Duke Professor Emeritus of English*  
 Frances Campbell Brown (1931), Ph.D., *Professor Emeritus of Chemistry*  
 Edwin H. Cady (1973), Ph.D., *Andrew W. Mellon Professor Emeritus in the Humanities*  
 Leonard Carlitz (1932), Ph.D., *James B. Duke Professor Emeritus of Mathematics*



William H. Cartwright (1951), Ph.D., *Professor Emeritus of Education*  
 Jack B. Chaddock (1966), Sc.D., *Professor Emeritus of Mechanical Engineering and Materials Science*  
 Frederic N. Cleaveland (1971), Ph.D., *Professor Emeritus of Political Science*  
 Kalman J. Cohen (1974), Ph.D., *Distinguished Bank Research Professor Emeritus*  
 Joel Colton (1947), Ph.D., *Professor Emeritus of History*  
 Robert Merle Colver (1953), Ed.D., *Associate Professor Emeritus of Education*  
 Thomas Howard Cordle (1950), Ph.D., *Professor Emeritus of Romance Studies*  
 Robert E. Cushman (1945), Ph.D., *Research Professor Emeritus of Systematic Theology*  
 Bingham Dai (1943), Ph.D., *Professor Emeritus of Psychology*  
 David G. Davies (1961), Ph.D., *Professor Emeritus of Economics*  
 William D. Davies (1966), D.D., F.B.A., *George Washington Ivey Professor Emeritus of Advanced Studies and Research in Christian Origins*  
 Eugene Davis Day (1962), Ph.D., *Professor Emeritus of Immunology*  
 Irving T. Diamond (1958), Ph.D., *James B. Duke Professor Emeritus of Psychology*  
 Neal Dow (1934), Ph.D., *Professor Emeritus of Romance Languages*  
 Francis George Dressel (1929), Ph.D., *Professor Emeritus of Mathematics*  
 Kenneth Lindsay Duke (1940), Ph.D., *Associate Professor Emeritus of Biological Anthropology and Anatomy*  
 George F. Dutrow (1976), Ph.D., *Professor Emeritus of Forestry and Environmental Studies*  
 Howard Easley (1930), Ph.D., *Associate Professor Emeritus of Education*  
 Ernest Elsevier (1950), M.S., *Associate Professor Emeritus of Mechanical Engineering*  
 Henry A. Fairbank (1962), Ph.D., *Professor Emeritus of Physics*  
 Arthur Bowles Ferguson (1939), Ph.D., *Professor Emeritus of History*  
 Oliver W. Ferguson (1957), Ph.D., *Professor Emeritus of English*  
 Donald J. Fluke (1958), Ph.D., *Professor Emeritus of Zoology*  
 Wallace Fowlie (1964), Ph.D., *James B. Duke Professor Emeritus of Romance Languages*  
 John Hope Franklin (1981), Ph.D., *James B. Duke Professor Emeritus of History*  
 Ernestine Friedl (1973), Ph.D., *James B. Duke Professor Emeritus of Anthropology*  
 William J. Furbish (1954), M.S., *Associate Professor Emeritus of Geology*  
 Thomas M. Gallie, Jr. (1954-55; 1956), Ph.D., *Professor Emeritus of Computer Science*  
 W. Scott Gehman, Jr. (1954), Ph.D., *Professor Emeritus of Psychology in Education*  
 Clarence Gohdes (1930), Ph.D., *James B. Duke Professor Emeritus of English*  
 John R. Gregg (1957), Ph.D., *Professor Emeritus of Zoology*  
 Samson R. Gross (1960), Ph.D., *Professor Emeritus of Biochemistry*  
 Kazimierz Grzybowski (1967), S.J.D., *Professor Emeritus of Political Science*  
 John W. Gutknecht (1969), Ph.D., *Professor Emeritus of Environment*  
 Herbert Hacker, Jr. (1965), Ph.D., *Associate Professor Emeritus of Electrical Engineering*  
 Hugh Marshall Hall, Jr. (1952), Ph.D., *Professor Emeritus of Political Science*  
 John Hamilton Hallowell (1942), Ph.D., *James B. Duke Professor Emeritus of Political Science*  
 Jerome S. Harris (1936), M.D., *Professor Emeritus of Biochemistry*  
 William S. Heckscher (1966), Ph.D., *Benjamin N. Duke Professor Emeritus of Art*  
 Henry Hellmers (1965), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Forestry*  
 Stuart C. Henry (1959), Ph.D., *Professor Emeritus of American Christianity*  
 Marcus Edwin Hobbs (1935), Ph.D., *University Distinguished Service Professor Emeritus of Chemistry*  
 Irving B. Holley, Jr. (1947), Ph.D., *Professor Emeritus of History*  
 Everett H. Hopkins (1961), M.A., LL.D., *Professor Emeritus of Education*  
 Alexander Hull (1962), Ph.D., *Associate Professor Emeritus of Romance Studies*  
 Wanda S. Hunter (1947), Ph.D., *Associate Professor Emeritus of Zoology*  
 Allan S. Hurlburt (1956), Ph.D., *Professor Emeritus of Education*  
 B. Jon Jaeger (1972), Ph.D., *Professor Emeritus of Health Administration*  
 Benjamin A. Jayne (1976), Ph.D., *Professor Emeritus of Forestry*  
 Bronislas de Leval Jezierski (1958), Ph.D., *Associate Professor Emeritus of Slavic Languages and Literatures*  
 Charles B. Johnson (1956), Ed.D., *Associate Professor Emeritus of Education*  
 Terry W. Johnson, Jr. (1954), Ph.D., *Professor Emeritus of Botany*  
 Alan C. Kerckhoff (1958), Ph.D., *Professor Emeritus of Sociology*  
 Robert B. Kerr (1965), Ph.D., *Professor Emeritus of Electrical Engineering*  
 Gregory A. Kimble (1952-68; 1977), Ph.D., *Professor Emeritus of Psychology*  
 John A. Koepke (1979), M.D., *Professor Emeritus of Pathology*  
 Paul Jackson Kramer (1931), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 Irwin Kremen (1963), Ph.D., *Assistant Professor Emeritus of Psychology*  
 Juanita Kreps (1957), Ph.D., *James B. Duke Professor Emeritus of Economics*  
 Wladyslaw W. Kulski (1963), Ph.D., LL.D., *James B. Duke Professor Emeritus of Russian Affairs*  
 Weston LaBarre (1946), Ph.D., *James B. Duke Professor Emeritus of Anthropology*  
 Leon Lack (1965), Ph.D., *Professor Emeritus of Pharmacology*  
 Creighton Lacy (1953), Ph.D., *Professor Emeritus of World Christianity*  
 Richard H. Leach (1955), Ph.D., *Professor Emeritus of Political Science*  
 Harold Walter Lewis (1946), Ph.D., *University Distinguished Service Professor Emeritus of Physics*  
 C. Eric Lincoln (1976), Ph.D., *William R. Kenan, Jr. Professor Emeritus of Religion*  
 L. Sigfred Linderoth, Jr. (1965), M.E., *Professor Emeritus of Mechanical Engineering*  
 Kenneth S. McCarty (1959), Ph.D., *Professor Emeritus of Biochemistry*  
 John Nelson Macduff (1956), M.M.E., *Professor Emeritus of Mechanical Engineering*

Sidney David Markman (1947), Ph.D., *Professor Emeritus of Art History and Professor Emeritus of Archaeology*  
 Richard S. Metzgar (1962), Ph.D., *Professor Emeritus of Immunology*  
 John W. Moore (1961), Ph.D., *Professor Emeritus of Neurobiology*  
 Montrose J. Moses (1959), Ph.D., *Professor Emeritus of Cell Biology*  
 Earl George Mueller (1945), Ph.D., *Professor Emeritus of Art*  
 Roland E. Murphy (1967-68; 1971), S.T.D., *George Washington Ivey Professor Emeritus of Old Testament*  
 Francis Joseph Murray (1960), Ph.D., *Professor Emeritus of Mathematics*  
 Aubrey Willard Naylor (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 Thomas H. Naylor (1964), Ph.D., *Professor Emeritus of Economics*  
 Yasuhiko Nozaki (1966), Ph.D., *Associate Professor Emeritus of Biochemistry*  
 Holger O. Nygard (1968), Ph.D., *Professor Emeritus of English*  
 James G. Osborne (1961), B.S., *Professor Emeritus of Forest Biometry*  
 Suydam Osterhout (1959), M.D., Ph.D., *Professor Emeritus of Microbiology and Immunology*  
 Athos Ottolenghi (1959), M.D., *Professor Emeritus of Pharmacology*  
 Harry Ashton Owen, Jr. (1951), Ph.D., *Professor Emeritus of Electrical Engineering*  
 Erdman B. Palmore (1967), Ph.D., *Professor Emeritus of Sociology*  
 Harold Talbot Parker (1939), Ph.D., *Professor Emeritus of History*  
 William Bernard Peach (1951), Ph.D., *Professor Emeritus of Philosophy*  
 Olan Lee Petty (1952), Ph.D., *Professor Emeritus of Education*  
 Leland R. Phelps (1961), Ph.D., *Professor Emeritus of Germanic Languages and Literature*  
 Jane Philpott (1951), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Wood Anatomy*  
 Jacques C. Poirier (1955), Ph.D., *Professor Emeritus of Chemistry*  
 William H. Poteat (1960), Ph.D., *Professor Emeritus of Religion*  
 Philip Pratt (1966), M.D., *Professor Emeritus of Pathology*  
 Jack J. Preiss (1959), Ph.D., *Professor Emeritus of Sociology*  
 Richard A. Preston (1965), Ph.D., *William K. Boyd Professor Emeritus of History*  
 James Ligon Price, Jr. (1952), Ph.D., *Professor Emeritus of Religion*  
 Louis DuBose Quin (1957), Ph.D., *James B. Duke Professor Emeritus of Chemistry*  
 Jacqueline A. Reynolds (1969), Ph.D., *Professor Emeritus of Cell Biology*  
 Lawrence Richardson, Jr. (1966), Ph.D., *James B. Duke Professor Emeritus of Classical Studies*  
 J. David Robertson (1966), M.D., Ph.D., *James B. Duke Professor Emeritus of Neurobiology*  
 Hugh G. Robinson (1964), Ph.D., *Professor Emeritus of Physics*  
 Theodore Ropp (1938), Ph.D., *Professor Emeritus of History*  
 Mabel F. Rudisill (1948), Ph.D., *Associate Professor Emeritus of Education*  
 Charles Richard Sanders (1937), Ph.D., *Professor Emeritus of English*  
 Lloyd Saville (1946), Ph.D., *Professor Emeritus of Economics*  
 Harold Schiffman (1963), Ph.D., *Professor Emeritus of Psychology*  
 Knut Schmidt-Nielsen (1952), D.Ph., *James B. Duke Professor Emeritus of Physiology and Zoology*  
 Anne Firor Scott (1961), Ph.D., *William K. Boyd Professor Emeritus of History*  
 William E. Scott (1958), Ph.D., *Professor Emeritus of History*  
 Joseph R. Shoenfield (1952), Ph.D., *Professor Emeritus of Mathematics*  
 William H. Simpson (1930), Ph.D., *Professor Emeritus of Political Science*  
 Donald S. Smith II (1961), M.H.A., *Assistant Professor Emeritus of Health Administration*  
 Grover C. Smith (1952), Ph.D., *Professor Emeritus of English*  
 William J. Stambaugh (1961), Ph.D., *Professor Emeritus of Environmental Studies*  
 William Franklin Stinespring (1936), Ph.D., *Professor Emeritus of Old Testament and Semitics*  
 Howard Austin Strobel (1948), Ph.D., *Professor Emeritus of Chemistry*  
 Charles Tanford (1960), Ph.D., *James B. Duke Professor Emeritus of Physiology*  
 Richard L. Tuthill (1953), Ed.D., *Professor Emeritus of Economic Geography*  
 Patrick R. Vincent (1954), Ph.D., *Associate Professor Emeritus of Romance Languages*  
 F. Stephen Vogel (1961), M.D., *Professor Emeritus of Pathology*  
 William D. Walker (1971), Ph.D., *Professor Emeritus of Physics*  
 Bruce W. Wardropper (1962), Ph.D., *William Haynes Wannamaker Professor Emeritus of Romance Studies*  
 Richard Lyness Watson, Jr. (1939), Ph.D., *Professor Emeritus of History*  
 Henry Weitz (1950), Ed.D., *Professor Emeritus of Education*  
 Paul Welsh (1948), Ph.D., *Professor Emeritus of Philosophy*  
 Robert W. Wheat (1958), Ph.D., *Professor Emeritus of Microbiology*  
 Pelham Wilder, Jr. (1949), Ph.D., *University Distinguished Professor Emeritus of Chemistry*  
 Hilda Pope Willett (1948), Ph.D., *Professor Emeritus of Microbiology*  
 George W. Williams (1957), Ph.D., *Professor Emeritus of English*  
 William Hailey Willis (1963), Ph.D., *Professor Emeritus of Greek in Classical Studies*  
 Thomas George Wilson (1959), Sc.D., *Professor Emeritus of Electrical Engineering*  
 Cliff W. Wing, Jr. (1965), Ph.D., *Professor Emeritus of Psychology*  
 Max A. Woodbury (1966), Ph.D., *Professor Emeritus of Computer Science*  
 James G. Yoho (1984), Ph.D., *Professor Emeritus of Forestry*  
 Charles R. Young (1954), Ph.D., *Professor Emeritus of History*  
 Franklin W. Young (1944-50; 1968), Ph.D., *Amos Ragan Kearns Professor Emeritus of New Testament and Patristic Studies*







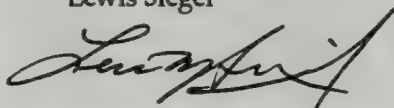
## TO THE PROSPECTIVE GRADUATE STUDENT

A graduate school is where excellence in scholarship is established in a university. At Duke, the Graduate School is where the two essential functions of a university, teaching and research, truly come together. Over the years Duke's strength at the graduate level has grown in all the main fields of knowledge. The 1980s were particularly fruitful years for recruitment of faculty, establishment of new programs, and attraction of outstanding students. The international distinction of the faculty continues to grow in the 1990s. The laboratories, libraries, and computer facilities, already among the very best, are targets of major enhancements in the next decade. Yet the Graduate School remains small enough so that personal contact is a central feature of our programs, and fruitful interaction across disciplines is a common experience, both for faculty and students.

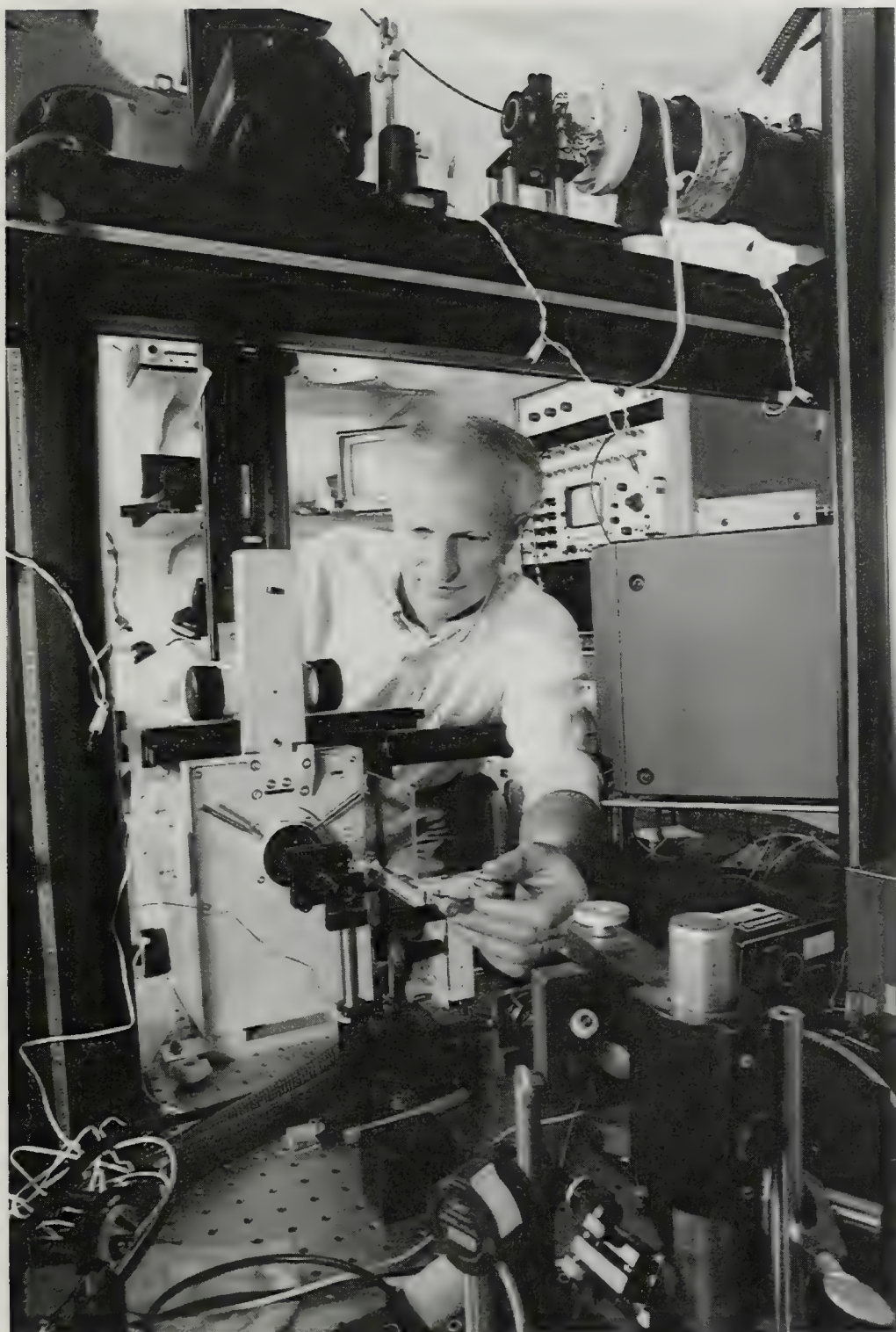
For the student in search of a strong graduate education, Duke University has much to offer. This is a community in which minds and ideas grow. We provide training for many careers, but we seek also to foster personal creativity and to provide stimulating yet congenial surroundings for productive education and research.

The following pages provide the information you require in making the important choice of the course of your graduate education. We look forward to welcoming you to the Duke community of scholars.

Lewis Siegel

A handwritten signature in dark ink, appearing to read 'Lewis Siegel', written in a cursive style.

*Dean of the Graduate School*



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## *Academic and Cooperative Programs*





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Cell Biology	Ph.D.	79
Chemistry	Ph.D.	82
Classical Studies	Ph.D.	85
Computer Science	Ph.D.	88
Cultural Anthropology	Ph.D.	94
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Engineering:		
Biomedical	Ph.D.	105
Civil and Environmental	M.S., Ph.D.	110
Electrical	M.S., Ph.D.	116
Mechanical and Materials Science	M.S., Ph.D.	121
English	Ph.D.	127
Environment	A.M., M.S., Ph.D.	130
Genetics	Ph.D.	141
Geology	M.S., Ph.D.	143
German Studies	Ph.D.	146
History	Ph.D.	152
Humanities	A.M.	158
Immunology	Ph.D.	159
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Microbiology	Ph.D.	175
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*Admission*



## Degree and Nondegree Admission

Students who wish to undertake graduate work at Duke University, whether for degree or nondegree purposes, must be formally admitted to the Graduate School by the dean. Prerequisites for admission include a bachelor's degree (or the equivalent) from an accredited institution and, for degree programs, satisfactory scores on the Graduate Record Examination. Individual departments may specify additional prerequisites, which can be found in the chapter on "Courses of Instruction."

Students who do not intend to earn an advanced degree at Duke, but who wish to take graduate courses, may apply for nondegree admission. Such admission is granted in three different categories: (1) admission as a regular nondegree student with a particular department; (2) admission as a special nondegree student without departmental affiliation through the Office of Continuing Education; and (3) admission as an unclassified student in the summer session only.

Credits earned by nondegree students in graduate courses taken at Duke before full admission to the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's director of graduate studies and approved by the dean, (2) the work is not more than two years old, (3) the amount of such credit does not exceed one semester at full-time tuition, and (4) the work has received grades of *G* or better.

Students who have discontinued a program of degree work at Duke must apply for readmission to the Graduate School. Those who discontinue study *prior* to completing a degree must, by letter, request permission of the dean to be readmitted to the degree program; those who discontinue study *after* earning a master's degree must file a new application for the doctoral program.

## Admission Procedures\*

A student seeking admission to the Graduate School should obtain an application bulletin from the Graduate School Admissions Office. This packet contains the necessary forms and detailed instructions on how to apply. All parts of the application forms must be filled out completely, signed, and returned to the Graduate School Admissions Office accompanied by the necessary supporting documents and a nonrefundable application fee. This fee is \$65† in U.S. currency (check or money order payable to Duke University

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\*This chapter is a brief summary of, and supplement to, information contained in the current Graduate School application bulletin, which should be consulted for more comprehensive information on all aspects of the process of applying for admission and award.

†All fees are based on current charges and are subject to change without notice.





through a U.S. bank). However, if the application is postmarked *and* completed by December 1, the fee is reduced to \$50. The required supporting documents are: (1) one copy of an official, *confidential* transcript from each institution (undergraduate or graduate) attended, sealed in a *confidential* envelope and signed-across-the-seal by the registrar at the institution; (2) three letters of evaluation, written on the forms provided and returned by the applicant in the confidential envelopes that have been sealed-then-signed by the evaluators; (3) official scores on the Graduate Record Examination General Test for applicants to all departments; and (4) official scores on the Graduate Record Examination Subject Test for applicants to certain specified departments. Please consult the current application bulletin for more detailed information on all requirements.

***Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.***

Students applying for fall admission and award should take the Graduate Record Examination no later than the October testing in the previous year in order to meet our deadlines. Information on the times and places of the Graduate Record Examinations can be obtained from the applicant's college or the Educational Testing Service, P.O. Box 6000, Princeton, New Jersey 08541-6000.

**Additional Procedures for Foreign Students.** Fully qualified students from outside the United States are invited to apply for admission to full-time study in the Graduate School. The foreign student must, in addition to the information required of all students, submit with the application materials: (1) if the student's native language is not English, certification of English proficiency demonstrated by official scores from the Test of English as a Foreign Language (TOEFL), administered through the Educational Testing Service, P.O. Box 6155, Princeton, New Jersey, 08541-6155 (the Graduate School requires a minimum score of 550); and (2) a statement showing financial arrangements for the proposed term at Duke (estimated costs per calendar year are about \$30,000-\$32,000).\*

**English Language Requirements for Foreign Students.** All international students whose native language is not English must enroll in two sections of English 200 during their initial year at Duke, unless formally waived from this requirement by the Graduate School upon certification of competency in English.

**Part-Time Graduate Study.** Many graduate departments will consider applications from students wishing to pursue degree study on a full-time or part-time basis. (Consult application materials for listing of departments.) Admission requirements, procedures, and deadlines are the same in either case. *Visa restrictions do not allow nonimmigrant students to pursue graduate study on a part-time basis.*

**Master of Arts in Liberal Studies Procedures.** Students seeking admission to the MALS should contact that program directly for information, requirements, and special application materials.

**Summer Session Procedures.** Students who wish to begin graduate work during the summer must check first with the department of interest concerning available courses or research work, as well as funding possibilities; some departments have summer offerings and others do not. Applications should be submitted according to the fall deadline schedule, since summer files will be reviewed along with others who plan to begin in late August.

In addition to the application for regular admission to the Graduate School, students must also apply directly to the summer session. Application forms and catalogues may

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\*Figures are based on 1994-95 charges and are subject to change without notice.

be obtained from Summer Session, Duke University, Box 90059, Durham, North Carolina 27708-0059, telephone (919) 684-2621.

Students who wish to take graduate courses in the summer but not pursue a graduate degree may be admitted to the summer session under the following categories. *Duke Students:* current students in good standing may attend the summer session without formal application. *Non-Duke Students:* other persons may seek admission to the summer session provided they are (or were) in good standing at a fully accredited college or university.

**Continuing Education Procedures.** A student seeking admission as a nondegree continuing education graduate student at Duke must have received a bachelor's degree and must either reside in the area or be moving to the area with the intention of residing here for a substantial period of time. Application materials and additional information may be obtained from the Office of Continuing Education, Duke University, Box 90700, Durham, North Carolina 27708-0700, telephone (919) 684-6259.

**Review of Application and Notification of Status.** All applications are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex, or age.

Application files are assembled in the Graduate School Admissions Office, where all official record-keeping is maintained. Applications, once processed, are sent to the departments. A departmental admissions committee, usually headed by the director of graduate studies, reviews the applications and makes recommendations to the dean. Formal admission to the Graduate School is offered only by the dean, who will send the official letter of admission and an acceptance form. The process of admission is not complete until the student returns the acceptance form.

*Admission may not be deferred from one term to another; an admission offer is only for the semester specified in the letter of admission.*

**Immunizations.** North Carolina Statute G.S.: 130A-155.1 states that no person shall attend a college or university, public, private, or religious, excluding students attending night classes only and students matriculating in off-campus courses, unless a certificate of immunizations against diphtheria, tetanus, whooping cough, poliomyelitis, red measles (rubeola), and rubella is presented to the college or university on or before the first day of matriculation. The required forms and instructions are provided to students in the packet of materials sent with the letter of admission.

## Deadlines for Application

It is the applicant's responsibility to make certain that the Graduate School Admissions Office has received all required materials by the appropriate deadlines. Only complete applications can be considered. To ensure that the admissions office will have adequate time to assemble all items submitted on an applicant's behalf, applications should be sent *at least* two weeks before the stated deadlines.

*Consult current application materials for a more detailed explanation of deadlines and their enforcement.*

### FOR FALL SEMESTER

**December 1.** Deadline for postmark *and completion* of applications eligible to pay the reduced application fee of \$50. All applications postmarked after this date must be accompanied by a fee of \$65 or they will not be processed.

**December 31.** Final deadline for postmark of applications for admission and award to all programs for the fall 1996 semester. (Note: Applications must arrive in the Graduate School within fourteen days of the December 31 postmark date.)

Applications postmarked *and* completed by this date are guaranteed a review; those postmarked/completed after this date are not guaranteed consideration. Late applica-

tions may be considered for admission only if all spaces have not been filled, and for financial aid, only if funds are still available. All students seeking fall admission should meet the December 31 deadline, since it is likely that enrollment in many departments will be filled soon after this date.

The final cut-off date for processing new applications is July 15. Few departments, however, continue to review applications this late. No applications for fall received after this date will be processed.

#### **FOR SPRING SEMESTER**

**November 1.** Final date for completion of applications for admission to the spring semester, space permitting. Not all departments accept new students for the spring semester, nor is financial aid readily available for spring matriculants.

#### **FOR SUMMER SESSION**

Students seeking admission to the Graduate School for study in the summer session should apply for Graduate School admission according to the fall deadline schedule and for summer session admission according to the following schedule:

**April 15.** Last day for completing summer session application to Term I.

**May 15.** Last day for completing summer session application to Term II.



*Financial Information*



## Fellowships and Scholarships

The Duke University Graduate School and its graduate programs offer a wide array of financial support. Funding is available from annually allocated awards funds, instruction, endowed fellowships, foundation and other private support, as well as federal research and training grants. A student who wishes to be considered for any of the fellowships or assistantships mentioned in this section should so indicate on the application form for admission and award. Selection of award recipients is made on the basis of academic merit and departmental recommendations.\*

(While personal financial need may not be the basis for the granting of many graduate awards, the Graduate School requests that all matriculating students complete the Free Application for Federal Student Aid. This application will be mailed to you upon acceptance.)

In addition to those awards available through the university, applicants are urged to compete for national and foundation awards available for graduate study. The following list provides a few of the awards available, from these sources, and from within the university.

### NATIONAL, REGIONAL, AND FOUNDATION AWARDS

**National Science Foundation Graduate Fellowships and Minority Fellowships:** predoctoral fellowships for students in the physical, biological, and social sciences. Applications are available from the National Science Foundation, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

**Jacob Javits Fellowships:** fellowships for students in the arts, humanities, and the social sciences. Javits Fellowship Program, U.S. Department of Education, Room 3514, Rob-3, Mail Stop 3327, Washington, D.C., 20202. (202) 732-2945.

**Howard Hughes Fellowships:** predoctoral fellowships in biological sciences. Applications are available from the Hughes Fellowship Program, The Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, D.C., 20148. (202) 334-2872.

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\*Students receiving financial support (other than loans) must be registered full time and must maintain satisfactory progress in their degree program.

**Andrew W. Mellon Fellowship:** predoctoral fellowship for students who aspire to teaching and scholarship in the humanities. For information write to Fellowships in Humanistic Studies, The Woodrow Wilson National Fellowship Foundation, P.O. Box 288 (300 Alexander Street), Princeton, N.J. 08542-0288. (609) 452-7007.

**Ford Foundation Predoctoral Fellowship for Minorities:** c/o Fellowship Office National Research Council, 2101 Constitution Avenue, Washington, D.C., 20418. (202) 334-2872.

**Shell Fellowships** are available to students in the social sciences engaged in dissertation research on developing countries. Recipients must be citizens of the United States or permanent residents intending to become United States citizens. The fellowships are designed to cover the expenses of field research in the preparation of doctoral dissertations. The stipend for each fellowship is \$7,000 plus a reasonable amount for transportation expenses. Recipients are chosen competitively from departmental nominees. Inquiries should be made to the Program Coordinator, Center for International Studies, 2122 Campus Drive, Durham, North Carolina 27706.

**Frederick K. Weyerhaeuser Forest History Fellowship.** This fellowship is available campus-wide to students who wish to study broadly in the area of forest and conservation history. The annual stipend is \$10,000. Inquiries should be made to the Forest History Society, 701 Vickers Avenue, Durham, North Carolina 27701.

## COMPETITIVE GRADUATE SCHOOL FELLOWSHIPS

These competitive fellowships are offered through the Graduate School. Normally, students will not make direct application to these awards, but are nominated by their department.

### Fellowships for Incoming Students

**James B. Duke Fellowships.** The James B. Duke One-Hundredth Anniversary Fund provides fellowships for students who wish to pursue a program leading to the Ph.D. degree in the Graduate School at Duke University. Its objective is to aid in attracting and developing outstanding scholars at Duke. Selection of recipients is made by a faculty committee upon nomination by the appropriate department. These fellowships provide a \$3,000 stipend supplement for four years to any other award the student receives from the department, the Graduate school, or national fellowships. In addition, the student will receive a cost of relocation allowance of \$1,000 upon matriculation.

**International Fellowships** are available to outstanding students from foreign countries. Fellowships provide an annual stipend of \$10,000, payable for twelve months, plus tuition and health fees. They are renewable for three years. Recipients are chosen competitively from departmental nominees by a faculty committee.

**Julian Price Fellowship:** provides competitive stipend and tuition for students in the humanities.

### Fellowships for Advanced Students

**Katherine Stern Fellowship:** dissertation-year fellowships provided for advanced graduate students.

**Named Instructorships in Arts and Sciences.** Five of these awards are provided jointly by the Graduate School and Trinity College. The student is required to teach one course during the academic year in which they hold the award.

**Aleane Webb Dissertation Research Fellowships** provide support for miscellaneous research projects associated with the dissertation.

**Conference Travel Awards** fund advanced students who are presenting papers at national conferences.



## International Research Opportunities

The Graduate School works to secure funding for advanced students who need to do research overseas. Below are a few of the programs currently available.

**Advanced International Fellowship:** The Graduate School offers several research awards to students who must travel overseas. This fellowship carries a stipend of \$10,000.

**Predissertation/Dissertation Travel Awards** are provided for overseas research travel.

**Organization for Tropical Studies:** the Graduate School provides limited funding for students to travel to Costa Rica to participate in this important program.

**Sigma Xi:** both the national and local chapters of this scientific honorary society offer research grants to graduate students. The Graduate School currently provides matching funding for these awards.

**Exchange Programs:** the Graduate School has developed exchange programs with a number of foreign universities, including the Free University of Berlin, and Potsdam and Humbolt universities.

**Social Science Research Council—Predissertation Fellowships:** offers important international fellowships at the early stages of research. Graduate School participation in this program also includes workshops treating problems and opportunities students may encounter while in the field.

## GRADUATE FELLOWSHIPS FOR MINORITY STUDENTS

**Duke Endowment Fellowships.** The Duke Endowment fellowship provides four years of graduate support. A stipend of \$11,00 for each calendar year, plus payment of tuition and registration and health fees for the fall and spring semesters, and registration and health fees for the summer sessions, is provided. Support for years one and two is provided by the Graduate School. Support for years three and four is provided by the department and may include service in the form of a research or teaching assistantship. In addition, in the fifth or final year, fellows are eligible to compete for dissertation support.

**Presidential Fellowships.** The Presidential Fellowship provides four years of graduate support. A stipend of \$11,200 for each calendar year, a book award of \$500, plus payment of tuition and registration and health fees for the fall and spring semesters, and registration and health fees for the summer sessions, is provided. Support for years one and two is provided by the Graduate School. Support for years three and four is provided by the department and may include service in the form of a research or teaching assistantship. In addition, in the fifth or final year, fellows are eligible to compete for dissertation support.

**Patricia Roberts Harris Fellowship Program.** This program makes direct fellowship grants available to colleges and universities for the purpose of providing financial support to minority and women graduate and professional students who demonstrate financial need. Duke has received fellowship support through this program and will continue to apply for this support for our graduate departments. The fellowships are funded by the Department of Education and are awarded for up to three years of graduate study.

**The National Consortium for Educational Access (NCEA) Fellowship.** The NCEA is a partnership agreement between historically black colleges and universities, Ph.D.-degree granting institutions, and corporations. The goals of the NCEA are (1) to increase the pool of black Americans holding the Ph.D. degree in disciplines where they are now underrepresented; and (2) to address the underrepresentation of black faculty in the nation's colleges and universities. The NCEA provides fellowship support for both students and faculty enrolled in a member Ph.D.-granting institution. Students are eligible to receive a minimum of \$3,000 per year, while faculty are eligible for a minimum of \$5,000 per year in assistance. These fellowships are in addition to financial assistance

the Ph.D. candidates receive from the participating institution. Students can apply for this fellowship directly through the NCEA by obtaining an application from a member institution or by writing to: Dr. Leroy Ervin, Executive Director, National Consortium for Educational Access, 296 Interstate North Parkway, Suite 100, Atlanta, GA 30339.

## **DEPARTMENTAL FELLOWSHIPS, ENDOWMENTS, RESEARCH AND INSTRUCTIONAL ASSISTANTSHIPS**

The majority of funding available for graduate study is provided by the student's department. Below are listed some of the ways a student may be supported. For specific information, contact the program director of graduate studies.

**Fellowships and Scholarships:** various departments offer fellowship stipends (ranging up to \$14,500), and tuition scholarships to students pursuing graduate studies. Information may be obtained from the individual departments.

**Endowed Fellowships:** Many departments offer endowed fellowship support. These include the Gurney Harris Kearns and the Gertrude Weil Fellowships in Religion, the Frank T. de Vyver and the Calvin Bryce Hoover Fellowships in Economics, the Clare Hamilton Memorial Endowed Fellowship in Clinical Psychology, the Charles R. Hauser Fellowship in Organic Chemistry, the Robert R. Wilson Fellowship in English, and the Anne McDougall Memorial Award in Women's Studies. Selection for these fellowships is made through faculty committees.

**Research Assistantships.** Appointments are available for graduate students whose special training and qualifications enable them to serve as assistants to individual staff members in certain departments. Stipends may be up to \$14,500 depending on the nature of the assistance and the assisting time required.

**Part-time Instruction.** Several departments offering graduate work have exceptionally qualified graduate students work as part-time instructors, tutors, and teaching assistants. Amounts of these assistantships vary and interested applicants should contact their departments directly.

## **PAYMENT OF AWARDS**

The payment of stipends for graduate assistantships and fellowships starts on September 25 and is made in equal payments on the twenty-fifth day of each month thereafter. Fellowship stipends are paid on the last working day of the month, beginning in September. Under the Tax Reform Act of 1986, the only graduate student financial assistance exempt from taxation are amounts paid for tuition, fees, books, supplies, and equipment required for course instruction. If services are required for payment of tuition and fees, then that tuition is considered income and is subject to taxation. The Graduate School office will supply detailed information.

It is the responsibility of the student to be sure that tuition and fees are paid or that arrangements have been made with the appropriate office or department for submission of tuition payment notices to the Bursar (101 Allen Building). Graduate students should contact either the director of graduate studies in their department or the Graduate School financial aid coordinator (120 Allen Building) depending upon the type of award. Faculty, senior administrative staff, employees, and eligible spouses not in degree programs should contact Jennifer Frazier (705 Broad Street) regarding tuition benefits.

## **LOANS**

Students who anticipate a need to supplement their financial resources through loans or college work-study employment must obtain and complete Free Application for Federal Student Aid. These forms are available at most financial aid offices or from the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706. A student seeking a loan should contact his or her state lending agency, or request an application from the Financial Aid Office.



Only students with full-time status who are U.S. citizens at permanent residents and who meet the federal criteria for need are eligible for loans. Loan funds are provided through the Carl Perkins Student Loan Program after a student has borrowed the maximum from the Federal Stafford Loan Program. Generally, loans made from these funds, as is the case with loans from state agencies, bear no interest charge to qualified borrowers while they maintain student status and for a short period thereafter. Interest during the repayment period is at a favorable rate.

Inquiries concerning loans should indicate the department of intended matriculation and include all pertinent information concerning application to a state agency. These inquiries should be addressed to the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706.

## **WORK-STUDY PROGRAM EMPLOYMENT**

Funds are available through the college work-study program for short-term or part-time employment of graduate students. A student who wishes to apply for work-study must complete a Free Federal Financial Aid form. Students considering the possibility of work-study for the fall should submit Free Federal Financial Aid forms by April 15. Eligibility requirements are similar to those of the federal loan programs. In addition to departmental employment opportunities, the placement office maintains a listing of employment openings for students.

## **SUMMER FINANCIAL AID**

A limited amount of financial aid is available to students in summer study. Summer financial aid, determined according to demonstrated need, may consist of institutional grant funds and/or low interest loans from the Stafford Student Loan program and the Carl Perkins Student Loan program. To qualify for summer school aid, a student must be enrolled or accepted for enrollment at Duke during the academic year immediately preceding the summer for which aid is requested. (Students must be registered for summer school in order to receive summer support. Students enrolled only for the summer may be eligible to borrow from outside lenders under the Stafford program in their home states or from the schools at which they are regularly enrolled. They should contact their college's financial aid office or the state's department of higher education for information and applications.) The college work-study aid is determined by the financial aid office based upon the student's financial need and the availability of funds. Graduate awards are determined by departments depending on usual criteria and availability of funds.

## **Student Expenses**

Although many students will receive financial assistance for their graduate education, students are responsible for ensuring that they have the means to support themselves, and the ability to pay tuition and fees due the university. Below is a summary of expected costs.

## **COST OF LIVING**

For 1994-95, the estimated cost of living in Durham for a single U.S. citizen (including health insurance but no other university fees) is approximately \$10,300 for the academic year. Obviously this cost will vary with individual needs. For a specific estimate of the cost of education for loan certification, contact the Graduate School Financial Aid Office. Cost may also differ for international students; contact Graduate Admissions for further information.



## TUITION AND FEES

### Tuition

Tuition is charged on a per semester basis for Ph.D. students, and on a per unit basis for masters and nondegree students. (The tuition rate for the masters programs in physical therapy and international development research are set separately from other graduate programs; information concerning these rates can be obtained from the program directors.)

For new Ph.D. students entering in fall 1995, the charge for tuition is \$6,540 per semester. A charge for tuition is levied for six semesters of graduate study. One semester of credit may be granted for those entering with a previous graduate degree or for nondegree work done at Duke prior to matriculation.

For masters and nondegree students, the tuition is \$545 per unit or semester hour.

### REGISTRATION FEE

All graduate students, with the exception of students registered through Continuing Education, will be charged a registration fee for every semester of residence. For 1995-96, the registration fee charge is \$900 per semester. Registration for summer 1996 is also \$900.

### TRANSCRIPT FEE

All entering students will be charged in the fall semester a one-time mandatory fee of \$30 for transcripts. This fee entitles the student to an unlimited number of Duke transcripts.

### STUDENT HEALTH FEE

All full-time students and part-time degree candidates are assessed a fee each semester for the use of the Student Health Service. For fall and spring, the fee is estimated at \$400 (\$200 each semester). For summer, the fee is estimated at \$125. This fee is distinct from health insurance, and does not provide major medical coverage. For the services covered by this fee see the chapter "Student Life".

### HEALTH INSURANCE

Students will be charged for health insurance in the fall semester, unless proof of other health insurance is provided. For 1994-95, the Student Health Insurance was \$618 for the full year. Information on the coverage provided by this insurance is available from the Office of the Bursar.

### STUDENT ACTIVITY FEE

All graduate students will be charged a student activity fee of \$7 per semester.

### OTHER FEES

**Thesis or Dissertation Fees.** Fees incurred in connection with a thesis or dissertation are currently as follows:

Binding fee, three university copies of thesis or dissertation	\$25
Microfilming fee, doctoral degree only, upon final submission	\$50
Copyright fee (doctoral degree only, optional)	\$35

**Marine Laboratory Fee.** For Marine Laboratory investigators' research table fee, see the publication *Marine Laboratory 1995*.

**Audit Fee.** Auditors are permitted on a space available basis with the consent of the instructor. Students registered full time during fall and spring may audit courses without charge. Audit fees are \$160 per course.

**Vehicle Fee.** Students should contact the University Parking Services Office (717 Broad Street) regarding parking fees.

## **PAYMENT OF ACCOUNTS FOR FALL AND SPRING**

The Office of the Bursar will issue invoices to registered students for tuition, fees, and other charges approximately four to six weeks prior to the beginning of classes each semester. The *total amount due* on the invoice is payable by the invoice late payment date which is normally one week prior to the beginning of classes. Inquire at the Bursar's Office, (919) 684-3541, if an invoice has not been received three weeks prior to the first day of classes, so that payment can be forwarded while a duplicate invoice is issued to document the balance owed. *As part of the admission agreement to Duke University, a student is required to pay all invoices as presented.* If full payment is not received, a late payment charge as described below will be assessed on the next invoice and certain restrictions as stated below will be applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. Nonregistered students will be required to make payment for tuition, fees, required deposits, and any past due balance at the time of registration.

**Monthly Payment Option.** The Monthly Payment Option Plan allows students to pay all or part of the academic years' expenses in ten equal monthly payments from July 1 to April 1. The only cost is an annual, nonrefundable fee of \$85. The participation fee can be paid by Visa or Mastercard. Payments may be made by check or by bank draft. Questions regarding this plan should be directed to Tuition Management Services, 1-800-722-4867 or 401-849-1550. At renewal, the plan can be extended to twelve months. The monthly payments can be increased or decreased without additional costs.

**Late Payment Charge.** If the total amount due on an invoice is not received by the invoice late payment date, the next invoice will show a penalty charge of 1 1/4 percent per month assessed on the past due balance regardless of the number of days past due. The past due balance is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loans or scholarship memo credits related to the previous balance which appear on the invoice.

**Restrictions.** An individual will be in default if the total amount is not paid in full by the due date. A student in default will not be allowed to receive a transcript of academic records, have academic credits certified, or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school and have the account referred to a collection agency. If an account is referred to a collection agency, the individual will be responsible for all applicable collection and/or court costs.

**Reduction in Registration and Tuition.** Full refunds are granted students who reduce registration on the drop/add date at the beginning of each semester. A reduction in registration and tuition necessitated by changes in departmental service requirements for assistants may be made during the first week of classes with approval of the dean.

**Refunds for Withdrawal from School during Fall and Spring Semesters.** For students who withdraw from school or who are withdrawn by the university, refunds of tuition are governed by the following policy.

1. In the event of death, refund of full tuition and fees will be granted.
2. In all other cases of withdrawal from the university, students may have tuition refunded according to the following schedule:
  - a. Withdrawal before classes begin: full refund;
  - b. Withdrawal during the first or second week of classes: 80 percent refund (fees will not be refunded);
  - c. Withdrawal during the third, fourth, or fifth week of classes: 60 percent refund (fees will not be refunded);



- d. Withdrawal during the sixth week: 20 percent refund (fees will not be refunded);
  - e. Withdrawal after the sixth week: no refund.
  - f. Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward.
3. If a student has to drop a course for which no alternate registration is available, drops special fee courses (music, golf, etc.), or drops a paid audit during the first two weeks of the drop/add period, a full refund may be granted with the approval of the dean. (The student health fee will not be refunded.)

**Special Tuition Benefits for Employees.** The Graduate School recognizes a special obligation to encourage the professional and personal advancement of employees. The university thus grants reductions in tuition to eligible employees enrolling in courses offered by the university.

Half-time employees with one or more years of continuous service who receive permission of their supervisors may take up to two courses a semester and will be charged one-half of the tuition rate. This benefit applies *only* to nondegree work. Full-time employees (30 or more hours a week) with two or more years of continuous service who receive permission to take such courses will be charged one-tenth the tuition rate for up to two courses per semester and will be permitted to audit at no charge. This benefit applies to degree work as well as nondegree. Tuition reduction for undergraduate or graduate course work is considered taxable income under current law.

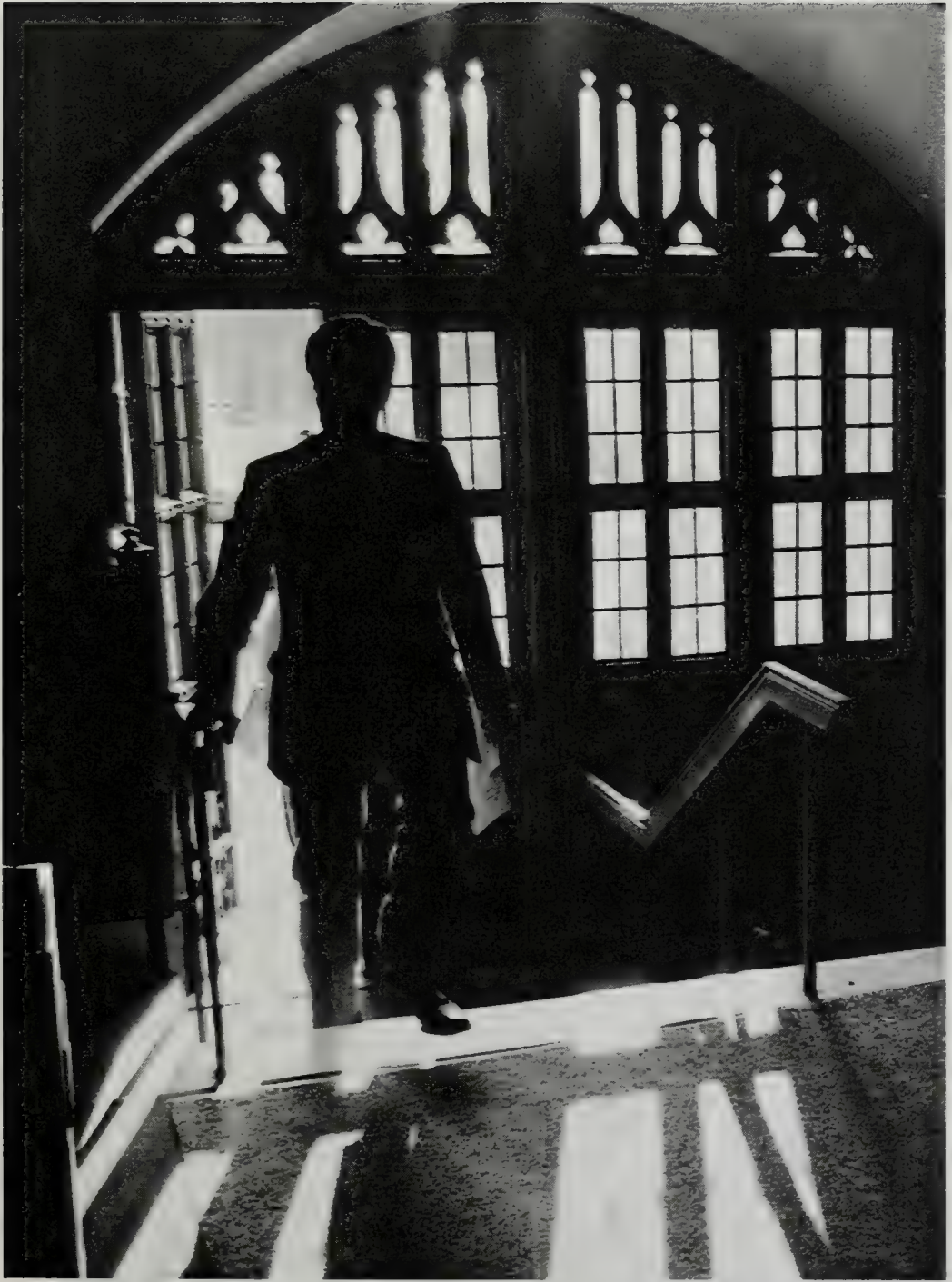
Employees who wish to take graduate classes on a nondegree basis apply through Continuing Education. No Graduate Record Exam is required at this point. If an employee is later admitted into a degree program, up to one semester of credit may then be transferred into that program if certain criteria are met (see page 55).

Employees wishing to enroll in a graduate degree program may apply directly to the Graduate School. Since not all of these programs can accommodate part-time study, please make early contact with the appropriate department for advice on your particular educational needs.

Eligible employees should consult the Benefits Office, 705 Broad Street, (919) 684-6723, at least three weeks in advance of payment date to obtain the appropriate tuition voucher.

**Satisfactory Progress.** Graduate students are expected to make satisfactory progress in their programs in order to remain enrolled in the Graduate School or to receive financial aid. Qualitative and quantitative requirements regarding formal coursework are detailed under the chapter of this bulletin entitled "General Academic Regulations," including regulations and regarding unsatisfactory or failing grades in major or related courses. Additional requirements may be imposed by individual departments, which are responsible for certifying at the conclusion of each academic year the satisfactory progress of all enrolled students. Finally, the Graduate School has established normative time requirements for completion of various stages of graduate degree work. Failure to meet expected time frames requires a review of the student's situation by the dean of the Graduate School, as specified in the chapter on "General Academic Requirements."





## *Registration*



## Registration

*All students who enrolled prior to fall 1994 should consult the bulletin of their year of matriculation for registration procedures and requirements.*

**Registration Requirements.** All students must register each fall and spring semester for "continuation" and pay a registration fee each semester until all degree requirements are completed, unless waived by an approved leave of absence granted by the dean. Failure to maintain "continuation" registration each fall and spring semester will result in administrative withdrawal from the university.

**Leave of Absence.** Students who have been on leaves of absence and who intend to resume a degree program must give the department and the dean notice of this intention two months before registration.

**Doctoral students.** In addition to "continuation," doctoral students must also register for a total of 6 semesters of full-time tuition. For Ph.D. students, approved transfer of an earned graduate degree may reduce the number of semesters of full-time tuition required for the degree to five semesters. After the 6 semesters of tuition, doctoral students will be charged only the registration fee. Specific course requirements for doctoral students are set by the departments.

**Master's students.** A master's student (except for those students enrolled in the two-year physical therapy and public policy studies programs) will register for a minimum of 30 units of degree credit and for any course units beyond the 30 required of their program. A registration fee and "continuation" registration for each semester are also required. Approved transfer course work into a master's program will *not* reduce the minimum registration for a master's degree of 30 units at Duke University.

*Except for these registration procedures, all other degree regulations remain as stated in the other sections of this bulletin.*

**Registration Periods.** All students who are enrolled in the Graduate School and who have not been granted a leave of absence by the dean must register each fall and



spring until all degree requirements are completed. New students will register immediately prior to the first day of classes in either term; continuing students register during the announced registration periods (set by the Registrar's Office) in November and April.

*Late Registration.* All students are expected to register at the times specified by the university. A late registration fee of \$25 is charged any student registering late, including a current student who delays registering until the registration for new students.

*Change of Registration.* During the first two weeks of the fall or spring semester, registration may be changed with the approval of the director of graduate studies if no reduction of fee is entailed. If fees are reduced, the approval of the dean of the Graduate School is required and must be received no later than the first week of the semester.

*Summer Registration.* Students who are in residence at Duke University during the spring and who plan to enroll for courses in the summer session may have their course programs approved by the director of graduate studies during the week of Graduate School registration in March. Summer session students may register at announced time beginning with the March registration period and up to the Wednesday preceding the start of the appropriate term. Graduate students who are in residence during the summer session, but not enrolled in any courses, pay only the registration fee.

The university does not mail statements for summer session tuition and fees. All tuition and fees should be paid in the Office of the Bursar (101 Allen Building) at least *five full working days* prior to the first day of class (see summer session calendar). Students who fail to register and pay all tuition and fees before this deadline will be assessed a late charge. Failure to pay tuition and fees by the end of the drop/add period will result in administrative withdrawal of the student.

Summer session students may add a course or courses before or during the first three days of the term. Courses may also be dropped before and during the first three days, but a 20 percent tuition fee will be charged (1) if the course is not dropped before the first day, and (2) the dropped course(s) results in a total tuition reduction. Courses dropped after the third day of classes are not eligible for tuition refund.

*Additional Registration Requirements.* It is necessary to be a fully registered student according to the regulations listed in the chapter on "Registration" in order to be eligible for library carrel and laboratory space, student housing, university and some outside loans, and the Student Health Service, including accident and sickness insurance. See the chapter on "Student Life."





# *Regulations*

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## General Academic Regulations

**Credits.** The following regulations pertain to credits earned outside the Duke University Graduate School:

*Graduate Credit Earned before the A.B. Degree Is Granted.* Ordinarily no credit will be allowed for graduate courses taken before a student has been awarded the A.B. or B.S. degree. However, an undergraduate student at Duke University, who at the beginning of the final semester lacks no more than three courses in order to fulfill the requirements of the bachelor's degree, may apply for admission to the Graduate School as a nondegree student for that final semester. If the student meets the requirements for admission in a nondegree program, permission may be obtained from the dean of the Graduate School to enroll for graduate courses to bring the total program to no more than four courses (only one semester of full-time tuition credit for the Ph.D. program will be granted to nondegree students.). In addition to undergraduate registration, the student must register in and pay tuition for those courses to the Graduate School at the beginning of the semester in which graduate credit is to be earned in order for the courses to be credited toward a graduate degree program.

*Transfer of Graduate Credits.* For master's programs, the transfer of graduate credit does not reduce the required minimum registration of 30 units for a master's degree at Duke. For Ph.D. students, one semester of full-time tuition credit may be given if the student has completed a graduate degree at another institution. No credit will be given to those students who wish to receive a master's degree en route to the Ph.D. Up to one semester of tuition credit may be given to students who have completed graduate course work at Duke as nondegree students. Financial credit for the above programs will be given only after the student has completed one full-time semester in a degree-granting graduate program. (For Ph.D. students, departments are free to consider previous course work in determining further course requirements for the student—academic credit is distinct from financial credit or registration requirements for the degree.)

*Summer Session Credit.* Summer session credit does not mean degree credit at Duke University unless the student has been admitted as a degree candidate by one of the colleges or schools of the university. The majority of summer session courses carry 3

units of credit and require one term of residence. (G. I. Bill benefits are available only to those veterans who enroll for credit.)

**Grades.** Grades in the Graduate School are as follows: *E*, *G*, *S*, *F*, and *I*. *E* (excellent) is the highest mark; *G* (good) and *S* (satisfactory) are the remaining passing marks; *F* (failing) is an unsatisfactory grade; and *I* (incomplete) indicates that some portion of the student's work is lacking, for an acceptable reason, at the time the grades are reported. For students enrolled in the Graduate School, the instructor who gives an *I* for a course specifies the date by which the student must make up the deficiency. If a course is not completed within one calendar year from the date the course ended, the grade of *I* becomes permanent and may not be removed from the student's record. The grade of *Z* indicates satisfactory progress at the end of the first semester of a two-semester course. For unclassified graduate students enrolled in the summer session, a temporary *I* for a course may be assigned after the student has submitted a written request. If the request is approved by the instructor of the course, then the student must satisfactorily complete the work prior to the last day of classes of the subsequent summer term. A grade of *F* in a major course normally occasions withdrawal from a degree program not later than the end of the ensuing semester or term; a grade of *F* in any other course occasions at least academic probation.

**Reciprocal or Interinstitutional Agreements with Neighboring Universities.** Under a plan of cooperation between Duke University and the University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University at Raleigh, full-time students properly enrolled in the Graduate School of Duke University during the regular academic year, and paying full tuition to this institution, may be admitted to a maximum of two courses per semester at one of the other institutions in the cooperative plan. Under the same arrangement, students in the graduate schools in the neighboring institutions may be admitted to course work at Duke University. Credit so earned is not defined as transfer credit. To take advantage of this arrangement during any summer session term, the student registers each term for 3 units of credit at the home institution and 3 units of credit at the other institution, for a total of 6 units. All interinstitutional registrations involving extra-fee courses or special fees required of all students will be made at the expense of the student and will not be considered a part of the Duke University tuition coverage. This reciprocal agreement does not apply to contract programs such as the American Dance Festival.

**Identification Cards.** Graduate students are issued identification cards which they should carry at all times. The card is a means of identification for library privileges, athletic events, and other university functions or services open to them as university students. Students will be expected to present their cards on request to any university official or employee. The card is not transferable, and fraudulent use may result in loss of student privileges or suspension from the Graduate School. A report of the loss of a card must be given immediately to the registrar's office. The cost of a new ID card is \$5.

**Courses Primarily for Undergraduates.** With the approval of their director of graduate students, master's degree students may take a total of two courses below the 200 level and have them count toward the 30 required for their degree, provided that two conditions are met:

1. that such courses be over and above the graduate course requirements set by the department; and
2. that a grade of *B* or better be earned.

At the master's level, only two such courses will be counted toward the 30 units. Ph.D. students may take undergraduate courses with the approval of their director of graduate studies.

**Withdrawal from a Course.** For permissible changes during the first two weeks of the fall or spring semester and during the first three days of summer session term, see



the chapter on "Registration." If a course is dropped without the necessary approval, the permanent record will, at the discretion of the dean of the Graduate School and with the permission of the instructor, list the course as *Withdrawal Error* (WE). If a course is dropped after the two-week period during the fall or spring or after the first three days of classes during the summer, the status of the student at the time of withdrawal from the course will be determined and indicated on the permanent record as *Withdrew Passing* (WP) or *Withdrew Failing* (WF).

**Interruption of Program and Withdrawal from the Graduate School.** Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in summary dismissal by the appropriate officer of the university.

The university reserves the right, and matriculation by the student is a concession to this right, to request the withdrawal of any student whose academic performance at any time is not satisfactory to the university. A student who wishes for any reason to withdraw from the Graduate School during the fall, spring, or summer session should notify in writing both the director of graduate studies in the major department and the dean of the Graduate School prior to the date of the expected withdrawal and no later than the published last day of classes for that semester or summer session. If students wish to withdraw from courses in the summer session, they must consult both the director of graduate studies in the major department and the director of the Summer Session. For refunds upon withdrawal, see the chapter on "Financial Information."

A student who, after successfully completing one semester of graduate study, must withdraw before completion of a graduate program may, with the approval of the major department, request the dean to issue a certificate of graduate study.

**Leave of Absence.** A leave of absence for a period of time no longer than one calendar year may be granted because of medical necessity, full-time employment, acceptance of an external award judged likely to benefit the student as an individual but not related to the degree requirements, or other acceptable reasons. A request for a leave of absence should be originated by the student, endorsed by the student's major professor and director of graduate studies, and submitted to the dean of the Graduate School for consideration prior to the beginning of the semester for which the leave is requested. A student is eligible to request a leave of absence only after having completed at least one semester at Duke. Time limitations which pertain to the various degrees and the completion of courses on which a grade of *I* (incomplete) was earned are not waived.

See page 33 of this bulletin for further English proficiency requirements for foreign students.

## Degree Regulations—The Master's Degrees

### MASTER OF ARTS

**Prerequisites.** As a prerequisite to graduate study in the major subjects, a student must have completed a minimum of 24 undergraduate semester hours—ordinarily 12 semester hours of approved college courses in the major subject and 12 semester hours in the major or in related work. Since some departments require more than 12 semester hours in the proposed field of study, students should read carefully the special requirements listed by their major departments in the chapter on "Courses of Instruction." If special master's requirements are not specified in this chapter and there is a question about the prerequisite, prospective students should write directly to the appropriate director of graduate studies.

**Language Requirements.** The Graduate School requires no foreign language for the master's degree. Certain departments, however, do have language requirements and



these must be satisfied before the master's examination can be taken. See the departmental listings in the chapter on "Courses of Instruction."

**Major and Related Subjects.** Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Arts degree. The students must present acceptable grades for a minimum of 24 units of graded course work, 12 of which must be in the major subject. A minimum of 6 units of the required 24 must be in a minor subject or in related fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and the dean of the Graduate School.

Individual departments decide whether the M.A. program may be completed by submission of an approved thesis or by other academic exercises (see requirements listed in the chapter on "Courses of Instruction"). In either case, a maximum of 6 units may be earned by the completion exercises and the final examination.

**Thesis Requirements.** The thesis should demonstrate the student's ability to collect, arrange, interpret, and report pertinent material on a research problem. The thesis must be written in an acceptable style and should exhibit the student's competence in scholarly procedures. Requirements of form are set forth in the *Duke University Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The thesis must be submitted in an approved form to the dean of the Graduate School on or before April 15 for a May degree, one week before the final day of the Duke University second summer term for a September degree, one week before the final day of the fall semester for a December degree, and at least one week before the scheduled date of the final examination. The copies of the thesis will be distributed by the student to the several members of the examining committee. Two copies for the library and one copy for the adviser will be bound upon payment of the university binding fee of \$25.

**The Examining Committee and the Examination.** The department's director of graduate studies recommends an examining committee composed of three members of the graduate faculty, one of whom usually must be from a department other than the major department or from an approved minor area within the major department. Nominations for membership on this committee are submitted for approval to the dean of the Graduate School at least one week preceding the final examination.

The committee will conduct the examination and certify the student's success or failure by signing the card provided by the Graduate School office. This card indicates completion of all requirements for the degree. If a thesis is presented, the committee members also sign all copies of the thesis, and the candidate then returns the original and first two copies to 013 Perkins Library.

## MASTER OF PUBLIC POLICY

See page 208 for a description of the M.P.P. degree.

## MASTER OF SCIENCE

**Prerequisites.** A bachelor's degree is a prerequisite for the M.S. degree. Departments offering an M.S. degree consider for admission students from allied fields provided they have satisfactory scientific and mathematical backgrounds.

**Language Requirements.** There is no foreign language requirement in Master of Science degree programs.

**Major and Related Subjects.** Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Science degree. The student must present acceptable grades for a minimum of 24 units of graded graduate courses. Of these, at least 12 units must be in the major subject. A minimum of 6 units must be in a minor

subject or in related fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and by the dean of the Graduate School. A maximum of 6 units may be earned either by submission of an approved thesis, or by completing courses or other academic activities approved by the student's department. As other requirements vary according to department, please consult the chapter on "Courses of Instruction" for further information.

**Thesis and Examination.** Some departments require a thesis; all departments require an examination. The regulations and options for theses and other means of completing the program, as well as the provisions for examination and the examining committee, are the same as the requirements for the Master of Arts degree.

## MASTER OF ARTS IN TEACHING

See page 240 for a description of the M.A.T. degree.

## Additional Master's Regulations

**Filing the Intention to Receive Degree.** On or before February 1 for a May degree, on or before August 1 for a September degree, or on or before December 1 for a December degree, and at least one month prior to the final examination, the student must file in the Office of the Graduate School, on the official form, a declaration of intention to graduate. The declaration of intention presents the title of the thesis or specifies alternative academic exercises on which the degree candidate will be examined. During their final semester students may not change from a thesis program to a nonthesis program or from a nonthesis program to a thesis program after this form has been filed with the Graduate School office. The declaration must have the approval of both the director of graduate studies in the major department and the chair of the student's advisory committee.

**Transfer of Credits.** A maximum of 6 units of graduate credit may be transferred for graduate courses completed at other schools. Such units will be transferred only if the student has received a grade of *B* (or its equivalent) or better. The transfer of graduate credit does not reduce the required minimum registration of 30 units for a master's degree at Duke. Requests for transfer should be submitted on the approved Graduate School form.

**Nondegree Students.** Credit for graduate courses taken at Duke by a student (not undergraduate) before degree admission to the Graduate School or while registered as a nondegree student through the Office of Continuing Education or the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's director of graduate studies and approved by the dean, (2) the amount of such credit does not exceed 12 units, (3) the work has received grades of *G* or better, (4) the work is not more than two years old, and (5) the student applies for and is granted formal admission into a degree program.

**Time Limits for Completion of Master's Degrees.** Master's degree candidates who are in residence for consecutive academic years should complete all requirements for the degree within two calendar years from the date of their first registration in the Graduate School. Candidates must complete all requirements within six calendar years of their first registration.

To be awarded a degree in May, the recording of transfer credit must be completed by the first day of the final examination period. If a thesis is one of the requirements, it must be submitted to the Graduate School office no later than April 15. Candidates desiring to have their degrees conferred on September 1 must have completed all requirements, including the recording of transfer of credit, by the final day of the Duke



University summer session. Candidates completing degree requirements after that date and during the fall will have their degrees conferred on December 30.

## **Degree Regulations—The Doctoral Degree**

**Requirements.** The formal requirements for the Ph.D. degree are as follows: (1) payment of 6 semesters of full-time tuition (or five if transfer credit has been approved), (2) major and related courses, (3) foreign language(s) in many departments, (4) a supervisory committee for the student's program of study, (5) residence, (6) preliminary examination, (7) dissertation, and (8) final examination.

**Major and Related Work.** The student's program of study demands substantial concentration on courses in the major department. However, a minimum of 2 courses in a related field approved by the major department must be included. A few programs have been authorized by the Executive Committee of the Graduate Faculty to utilize courses in fields within the major department in fulfilling the related field requirement. If there are deficiencies in a student's undergraduate program, departments may require certain undergraduate courses to be taken. In all cases the student's supervisory committee will determine if the student must meet requirements above the minimum.

**Foreign Languages.** The Graduate School has no foreign language requirement for the Ph.D. Some departments require two languages; other departments have no foreign language requirements. For specific departmental requirements, see the chapter on "Courses of Instruction" or contact the appropriate director of graduate studies.

**English Language Proficiency.** All international Ph.D. students are subject to the requirement described on page 33 of this bulletin.

**Committee to Supervise the Program of Study.** As early in a student's course of study as is practicable and not later than two months before the preliminary examination, the director of graduate studies in the major department will nominate for the approval of the dean a supervising committee consisting of at least four members, with one member designated as chair. This committee will include at least three graduate faculty members of the major department and, usually, at least one from outside the department. For programs in which approval has been granted for related work from a clearly differentiated division within the department, one member of the committee may be chosen from that division. This committee, with all members participating, will determine a program of study and administer the preliminary examination.

**Residence.** The minimum residence requirement is one academic year of full-time registration at Duke (that is, two consecutive semesters of full-time tuition).

**Time Limits.** Ordinarily a student registered for full-time study should pass the preliminary examination by the end of the third year. A student who has not passed the examination by the end of this time must file with the dean of the Graduate School a statement, approved by the director of graduate studies in the major department, explaining the delay and setting a date for the examination. Except under unusual circumstances, extension will not be granted beyond the middle of the fourth year.

The doctoral dissertation should be submitted and accepted within two calendar years after the preliminary examination is passed. Should the dissertation not be submitted and accepted within four years after the examination, the candidate may, with the approval of the committee, petition the dean of the Graduate School for an extension of up to one year. If this extension is granted and the dissertation is not submitted and accepted by the new deadline, the student may be dropped from candidacy. The student must then pass a second preliminary examination to be reinstated as a candidate for the degree. In such cases, the time limit for submitting the dissertation will be determined by the dean of the Graduate School and the candidate's committee.



Ordinarily, credit is not allowed for graduate courses (including transfers) or foreign language examinations that are more than six years old at the date of the preliminary examination. Similarly, credit will not be allowed for a preliminary examination that is five years old at the date of the final examination. In cases of exceptional merit, however, the dean of the Graduate School may extend these limits. Should the five-year limits be exceeded, the student's department must submit to the dean specific requirements for revalidating credits.

**Preliminary Examination.** A student is not accepted as a candidate for the Ph.D. degree until the preliminary examination has been passed. The examination ordinarily covers both the major field and related work, although some departments cover such field expertise in a separate qualifying examination. Please consult the chapter on "Courses of Instruction" for individual department procedures. In the summer a preliminary examination may be scheduled only between the opening and closing dates of the summer session.

Successful completion of the preliminary examination requires at least three affirmative votes and no more than one negative vote. The sole exception to this policy is that a negative vote cast by the chair of the examining committee will mean a failure on the examination. A student who fails the preliminary examination may apply, with the consent of the full supervisory committee and the dean of the Graduate School, for the privilege of a second examination to be taken no earlier than three months after the date of the first. Successful completion of the second examination requires the affirmative vote of all five committee members. Failure on the second examination will render a student ineligible to continue a program for the Ph.D. degree at Duke University.

**The Dissertation.** The dissertation is expected to be a mature and competent piece of writing, embodying the results of significant and original research.

One month before the dissertation is presented and no later than February 1 preceding the May commencement, August 1 for a September degree, and December 1 for a December degree, the student must file with the dean of the Graduate School, on the official form available in the Graduate School office, the title of the dissertation. This title must receive the written approval of both the director of graduate studies of the student's major department and the professor who directs the dissertation.

The basic requirements for preparing the dissertation (type of paper, form, and binding) are prescribed in the *Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The dissertation must be completed to the satisfaction of the professor who directs the dissertation, members of the student's advisory committee, and the dean of the Graduate School. A copy of the dissertation must be submitted to the dean of the Graduate School on or before April 1 preceding the May commencement, one week before the end of the Duke summer session for a September degree, or one week before the end of the fall semester for a December degree. The dissertation must be submitted to the Graduate School office at least seven days before the scheduled date of the student's examination.

All doctoral dissertations are published on microfilm through University Microfilms, Ann Arbor, Michigan. Authors may copyright them if they wish. Abstracts are published in *Dissertation Abstracts International*.

Two extra copies of the abstract (not more than 350 words long) are submitted when the dissertation is presented to the Graduate School office. A nonrefundable fee of \$50 is charged for microfilming. If copyright is desired, an additional fee of \$35 is charged. The original and two copies will be bound at a cost of \$25.

**Final Examination.** The final examination is administered by at least four members of the supervising committee. The final oral examination shall be primarily on the dissertation; however, questions may be asked in the candidate's major field. Except in

unusual circumstances approved by the dean, a final examination will not be scheduled when the university is not in session.

Successful completion of the preliminary examination requires at least three affirmative votes and no more than one negative vote. The sole exception to this policy is that a negative vote cast by the chair of the examining committee will mean a failure on the examination. A student who fails the final examination may be allowed to take it a second time, but no earlier than six months from the date of the first examination. Permission to take the second examination must be obtained from the professor who directed the dissertation and from the dean of the Graduate School. Failure to pass the second examination renders the student ineligible to continue work for the Ph.D. degree at Duke University.

**Deposit of the Dissertation.** After passing the examination, candidates return the original and the first two copies of the dissertation, properly signed to 013 Perkins Library. At this time they sign the microfilming agreement and pay microfilming and copyright fees.

## Commencement

Graduation exercises are held once a year, in May, when degrees are conferred on and diplomas are issued to those students who have completed requirements by the end of the spring. Those who complete degree requirements by the end of the fall or by the end of a summer term receive diplomas dated December 30 or September 1, respectively. There is a delay in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

## Standards of Conduct

Duke University expects and will require of all its students cooperation in developing and maintaining high standards of scholarship and conduct.

Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in *summary* dismissal by the appropriate officer of the university.

The university wishes to emphasize its policy that all students are subject to the rules and regulations of the university currently in effect or which, from time to time, are put into effect by the appropriate authorities of the university. Students, in accepting admission, indicate their willingness to subscribe to and be governed by these rules and regulations and acknowledge the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university.

Duke University, as a community of scholars, strongly relies upon the standard of academic integrity. Plagiarism and other forms of academic dishonesty represent a corruption of this integrity and, as such, cannot be tolerated within the community. Ignorance of what constitutes academic dishonesty is no excuse for actions which violate the integrity of the community. In a community which builds on the notion of academic integrity, the threat of academic dishonesty represents an intolerable risk. Students unsure about the university definition of plagiarism may wish to consult the *Bulletin of Duke University: Information and Regulations* (especially the chapter on "Academic Honesty").

**Sexual Harassment Procedures.** A committee of students, faculty, and administrators exists at Duke to respond to concerns about sexual intimidation in any form. For



confidential assistance and information on procedures, contact Professor Nancy Hewitt (Department of History), 684-2505.

**Student Grievance Procedures.** It is the responsibility of the director of graduate studies to inform each graduate student of the appropriate channels of appeal. In normal circumstances, the director of graduate studies is the first to hear a complaint. If the complaint cannot be resolved satisfactorily at this level, the student may address, in turn, the department chair, the associate dean of the Graduate School, the dean of the Graduate School, the provost, and as a last resort, the president of the university.

**Judicial Code and Procedures.** In the spring of 1971, the Graduate School community ratified and adopted the following official judicial code and procedures:

#### **I. Graduate School Judicial Code and Procedures**

A. A student, by accepting admission to the Graduate School of Duke University, thereby indicates willingness to subscribe to and be governed by the rules and regulations of the University as currently are in effect or, from time to time, are put into effect by the appropriate authorities of the University, and indicates willingness to accept disciplinary action, if behavior is adjudged to be in violation of those rules or in some way unacceptable or detrimental to the University. However, a student's position of responsibility to the authorities and the regulations of the University in no way alters or modifies responsibilities in relation to civil authorities and laws.

B. A graduate student at Duke University stands in a primary and unique relation of responsibility to the faculty in the major department, the faculty upon whose recommendation a graduate degree will or will not be awarded to the student. In matters which involve or may affect the student's intellectual or professional life, the student is directly responsible to this department and its representatives, and such matters should primarily be handled by the department.

C. Actions which appear to conflict with University-wide rules and regulations will fall under the jurisdiction of the University Judicial Board.

D. A student may elect to have the Dean of the Graduate School hear matters related to the student's conduct in addition to or instead of faculty members from the student's major department, or may elect to have such matters reviewed and judged by a judicial board instead of the Dean of the Graduate School or members of the faculty in the major department. (The constitution and procedure of the judicial board are detailed below.)

E. The Director of Graduate Studies in the student's major department may request that a student's actions be reviewed by the Judicial Board or by the Dean of the Graduate School.

#### **II. The Graduate School Judicial Board**

A. *Composition.* The Graduate School Judicial Board shall have five members, serving for a period of two years: two students selected from the student body, two members of the Graduate Faculty appointed by the Executive Committee of the Graduate School, and one Associate or Assistant Dean appointed by the Dean of the Graduate School. The Board shall elect one of its members as Chairman. The Board shall have at its service a recording secretary to keep minutes of the hearings and of the Board's actions in a permanent, confidential record book. The Board will be constituted in order to hear cases in which the accused is a student currently enrolled in the Graduate School and which have been referred to it by the Director of Graduate Studies in the student's department, by the Dean of the Graduate School, or by the student himself.

B. *Preliminary Procedures.* If a student requests a hearing by the Judicial Board it must be done in writing, allowing its Chairman at least seventy-two hours to convene the Board. In addition, the Chairman shall not convene the Board until seventy-two hours after being asked to convene the Board. It is the responsibility of the Chairman of the Judicial Board fully to inform its members concerning the case and the reasons the case has been referred to the Board; and to prepare a written summary of this information for the Board, the Dean, and the student.

C. *Procedural Safeguards for the Hearing.* The Accused has the right to challenge any member of the Judicial Board on grounds of prejudice. If the Board decides to excuse one or more of its members for reasons given by the Accused, it shall consult with the Dean about the need for replacements. The Accused may choose an Adviser to assist in the defense. The Accused may also produce witnesses (including no more than two character witnesses), introduce documents, and offer testimony. A person having direct knowledge relevant to a case being heard by the Board is a material witness. The Judicial Board may request the appearance of material witnesses. The Board shall also request, upon written request of the Complainant or the Accused, the appearance of material witnesses. Witnesses shall be notified of the time, place, and purpose of their appearance. The Accused has the right to examine the written statement of any witness relevant to the case at least seventy-two hours before the hearing. The Accused has the right to be faced with any witness who has given a statement relevant to the case at the hearing if the witness's attendance can be secured.



The hearing will be conducted in private unless the Accused requests an open hearing. If any objection is raised to conducting an open hearing in any particular case, the Judicial Board shall decide the issue by majority vote. If the decision is made not to hold an open hearing, the Accused shall be informed in writing of the reasons for the decision.

The Judicial Board shall consider only the report of the Chairman, documents submitted into evidence, and the testimony of witnesses at the hearing in reaching its decisions.

**D. Conduct of the Hearing.** The hearing of any case shall begin with a reading of the charge by the Chairman in the presence of the Accused. The Accused shall then plead guilty or not guilty or move to terminate or postpone the hearing. The Accused may qualify a plea, admitting guilt in part and denying it in part. The Accused may not be questioned for more than one hour without recess.

At any time during the hearing, the Accused or the Judicial Board may move to terminate or to postpone the hearing or to qualify the plea or to modify its charge.

Pending verdict on charges (including appeal) against the Accused, status as a student shall not be changed, nor the right to be on campus or to attend classes suspended, except that the Chancellor or Provost may impose an interim suspension upon any member of the University community who demonstrates, by conduct, that continued presence on the campus constitutes an immediate threat to the physical well-being or property of members of the University community or the property or orderly functioning of the University.

**E. Sanctions and the Verdict.** The Graduate School Judicial Board shall have the power to impose the following penalties: expulsion, dismissal from the University with the recommendation that the person never be readmitted; suspension, dismissal from the University and from participation in all University activities for a specified period of time, after which the student may apply for readmission; disciplinary probation, placing the student on a probationary status for a specified period of time, during which conviction for violation of any regulation may result in more serious disciplinary action; restitution, payment for all, or a portion of property damage caused during the commission of an offense. Restitution may be imposed by itself or in addition to any of the other penalties. The Judgment shall consist of a finding of guilty or not guilty of the charge and, when the Accused is found guilty, a statement of the punishment assessed. On all questions, including the verdict and the finding of guilty or not guilty, the Board shall be governed by a majority vote. The Judicial Board may decide to rehear a case in which significant new evidence can be introduced. In addition, the defendant may request an appeal.

**F. Appeals.** The appellant may submit to the Dean a written statement containing the grounds for appeal and arguments. In such cases, the Dean should determine if the appeal should be granted, and the Dean can hear the case, or refer it to the appropriate faculty in the student's department or to the Judicial Board.

An appeal shall be granted on the following grounds: procedural error substantially affecting the rights of the accused; incompatibility of the verdict with the evidence; excessive penalty not in accord with "current community standards;" new evidence of a character directly to affect the judgment but on which the original tribunal had refused a new hearing.

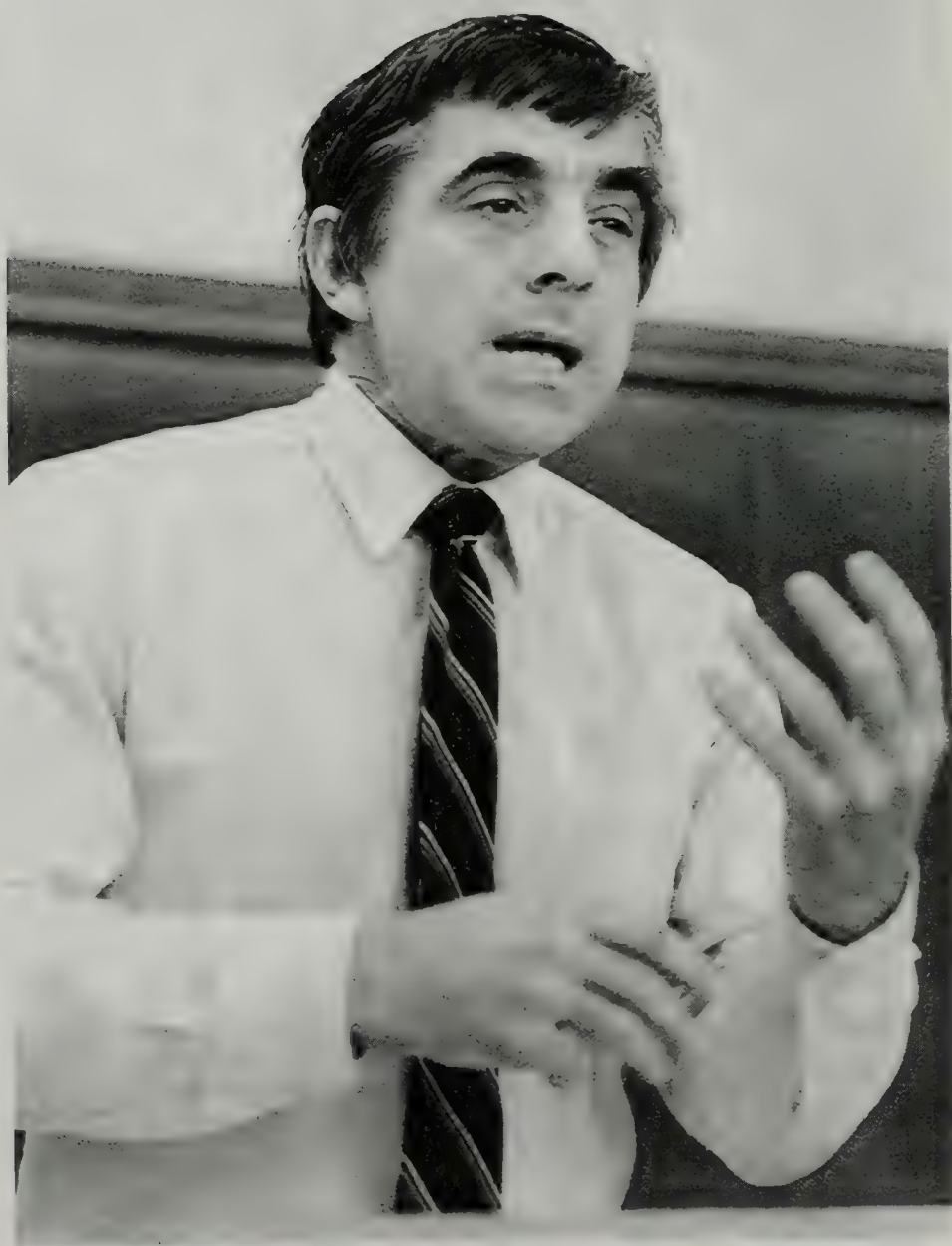
### III. Amendment and Construction

This Judicial code and procedure and this constitution and procedure for the Graduate School Judicial Board may be amended at any time with due notice or publication by consent of the Dean, the Executive Committee, and the graduate students. Questions and problems not answered or anticipated by the foregoing may be resolved by the use of other existing institutions or by amendment.



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## *Courses of Instruction*





## Course Enrollment

Courses numbered 200-299 are sometimes open to qualified undergraduate students who have received permission of the instructor and the director of graduate studies. Undergraduate students are not permitted in any courses above 300. Odd-numbered courses are usually offered in the fall semester, even-numbered courses in the spring semester. Double numbers separated by a hyphen indicate that credit is contingent upon completion of both courses. Double numbers separated by a comma indicate that although the course is a year-long course, credit may be received for either course or both courses.

The following symbols, suffixed to course numbers, identify the small group learning experiences: *S*, seminar; *P*, preceptorial; *T*, tutorial; *D*, discussion section. The *L* suffix indicates that the course includes laboratory experience. *C-L*: denotes a course that is cross-listed or a program under which a course is listed.

## Art and Art History

Associate Professor Wharton, *Chair* (112A East Duke Building); Associate Professor Powell, *Director of Graduate Studies* (111B East Duke); Professor Bruzelius;\* Associate Professor Van Miegroet; Assistant Professors Abe, Cernuschi, Cormack, Rice, and Stiles; Professors Emeritus Markman; Associate Professor of the Practice Tronzo; Adjunct Professor Mezzatesta; Adjunct Associate Professor Reents-Budet

The Department of Art and Art History offers graduate work leading to the Ph.D. degree in art history. The program, which has a strong interdisciplinary component, provides students with a thorough grounding in the formal and iconographic aspects of artworks and monuments as well as in their theoretical and historical context. Course work has been designed to prepare students for careers in art and architectural criticism, research and teaching in the academy, museum, and art gallery.

Concurrently with their work toward a Ph.D., students may satisfy the requirements for a Certificate of Museology. Students are required to have demonstrated their ability to read German and at least one other foreign language relevant to their chosen area of research before taking their preliminary examination. For further information on the program, prospective applicants may write to the director of graduate studies.

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\*Currently on leave.

Applicants to the program in art history should provide a copy (not returnable) of a research paper (8-10 pages) as a writing sample.

### **For Seniors and Graduates**

**201S. Topics in Greek Art.** Specific aspects of the art or architecture in the Greek world from the late Geometric to the Hellenistic periods. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 220S. 3 units. *Cormack*

**202S. Topics in Roman Art.** Selected topics in the art and architecture of late republican and imperial Rome. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 227S. 3 units. *Cormack*

**216. The Art of the Counter Reformation.** Religious art in Catholic Europe during and following the Council of Trent. Issues such as the rise of the new religious orders; the revival of interest in the early Church and the origins of Christian archaeology; the Church's use of art in its war against Protestantism. Considers the validity of the concept of a counter-reformation style. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

**233S. Topics in Early Christian and Byzantine Art.** Specific conceptual, institutional, or formal problems in the art of the late antique world or of the east Roman Empire. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 230S, Medieval and Renaissance Studies, and Religion 275S. 3 units. *Wharton*

**236S. Topics in Romanesque and Gothic Art and Architecture.** Analysis of an individual topic. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Bruzellius or Tronzo*

**237S. Greek Painting.** See C-L: Classical Studies 232S. 3 units. *Stanley*

**238S. Greek Sculpture.** See C-L: Classical Studies 231S. 3 units. *Younger*

**241-242. History of Netherlandish Art and Visual Culture in a European Context.** A contextual study of visual culture in the Greater Netherlands and its underlying historical and socioeconomic assumptions from the late medieval to early modern period, through immediate contact with urban cultures, such as Amsterdam, Leiden, Utrecht, Brussels, Ghent, Bruges, and Antwerp. Includes daily visits to major museums, buildings, and sites; hands-on research in various collections; discussion sessions with leading scholars in the field; and a critical introduction to various research strategies. (Taught in the Netherlands.) Not open to students who have taken Art and Art History 158-159. 6 units. *Van Miegroet*

**243S. Topics in Netherlandish and German Art.** Specific problems in northern Renaissance or baroque art such as the Antwerp workshops of the sixteenth century or a critical introduction to major artists such as Van Eyck, Bosch, Dürer, and Rubens. An analytical approach to their lives, methods, atelier procedures and followers; drawings and connoisseurship problems; cultural, literary, social, and economic context; documentary and scientific research strategies. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

**244A, S. International Expressionism.** A synchronic view of the expressionist revolution in modern aesthetic conceptions throughout Europe in the period 1905-1925, emphasizing fusions of established aesthetic modes with new technological media, and the opening up of the Western tradition to other cultures, especially African. German expressionism forms the nucleus of the course and its study is integrated with the theory and practice of Italian futurism, Anglo-American imagism and vorticism, French surrealism, and Russian rayonnism. Not open to students who have taken Art 244S or German 244S. C-L: German 244A. 3 units. *Cernuschi and Rolleston*

**244B, S. International Modernism.** An interdisciplinary view of the various aesthetic and literary manifestations of European modernism: cubism, imagism, futurism, vorticism, suprematism, constructivism, dadaism, expressionism, and surrealism. C-L: German 244B. 3 units. *Cernuschi and Rolleston*

**247S. Topics in Italian Renaissance Art.** Specific problems dealing with iconography, style, or an individual master from c. 1300 to 1600. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

**257S. Topics in Pre-Columbian Art and Culture.** Selected topics in pre-Columbian art and archaeology with an emphasis on the political and cultural context of the artifact. Subject varies from year to year. Consent of instructor required. 3 units. *Reents-Budet*

**260S. Topics in Italian Baroque Art.** Problems in Italian art and architecture from c. 1580 to c. 1750. Topics vary from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

**265S. Topics in Nineteenth-Century Art.** Focus on a major artist, movement, or trend in nineteenth-century art. Subject varies from year to year. Consent of instructor required. 3 units. *Cernuschi or Stiles*

**270S. Topics in African Art.** Specific problems of iconography, style, or a particular art tradition. Subject varies from year to year. Consent of instructor required. 3 units. *Powell*

**271S. Topics in Art of the United States.** Selected topics from colonial times to 1945, with emphasis on major cultural issues, movements, works, and/or artists. Consent of instructor required. 3 units. *Powell or Stiles*

**272S. Topics in Chinese Art.** Problems and issues in a specific period or genre of Chinese art. Specific focus varies from year to year. 3 units. *Abe*

**283S. Topics in Modern Art.** Selected themes in modern art before 1945, with emphasis on major movements or masters. Subject varies from year to year. Consent of instructor required. 3 units. *Cernuschi or Stiles*

**291, 292. Independent Study/Special Problems in Art History.** Directed reading and research. Consent of instructor required. 3 units each. *Staff*

**296S. Methodology of Art History.** Approaches to the study and theory of art: historiography, connoisseurship, iconology, and criticism. Consent of instructor required. 3 units. *Staff*

**297S. Topics in Art since 1945.** Historical and critical principles applied to present-day artists and/or movements in all media since World War II. Consent of instructor required. 3 units. *Cernuschi or Stiles*

**298S. Topics in Modern and Postmodern Architecture.** The study of particular architects, movements, or building genres in their conceptual and political contexts. Subject varies from year to year. Consent of instructor required. 3 units. *Wharton*

**299S. Critical Theory.** Understanding of the visual arts in terms of the theoretical developments in other disciplines (for example, literature, women's studies, Marxism, and anthropology). Focus on the writings of theory-centered art historians and critics. Consent of instructor required. 3 units. *Cernuschi, Stiles, or Wharton*

#### **For Graduates**

**300. Pedagogy in Art History.** Instruction and practice in the teaching of art history. Credit/no credit. No credit. *Staff*



**301. Museum Studies.** Introduction to the organization and functions of the museum in preparation for the presentation of a student-organized exhibition. Most of the semester spent in independent study researching scholarly, critical essays for the catalog. 3 units. *Mezzatesta*

**302. Museum Studies.** Completion of research and preparation of the catalog. Students actively participate in catalog design and production, and will be responsible for planning and installing the exhibition as well as interpreting it to the public through lectures and tours. 3 units. *Mezzatesta*

**391, 392. Individual Research in Art History.** Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units each. *Staff*

**393. Colloquium in the History of Art.** Topics of interest to art historians in every field, including "The Question of Originality," "Implications of the Frame (or its absence)," and "Art and Economy: The Impact of the Market on Visual Production." Faculty and students participate in the forum. Consent of instructor required. 3 units. *Staff*

**394. Graduate Symposium.** Graduate students deliver major research papers to their peers, faculty, and interested visitors. A one-day event organized by participating graduate students, supervised by a student-faculty committee, and scheduled annually sometime in April. Consent of instructor required. 3 units. *Staff*

**395. Topics in Art History.** In-depth consideration of a specific art historical problem of a formal, historical, or conceptual nature. 3 units. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**205S. Greek Architecture**

**206S. Roman Architecture**

**227S. Roman Painting**

### **Asian and African Languages and Literature**

Associate Professor Wang, *Director*

Courses in the following languages are taught currently and regularly in Asian and African Languages and Literature: Arabic, Chinese, modern Hebrew, Hindi, Japanese, Korean, and Swahili. In addition, courses in Persian are taught on an irregular basis. Some of the literature courses are taught in English translation.

For a detailed listing of course offerings, see the Asian and African Languages and Literature section in the *Bulletin of Duke University: Undergraduate Instruction*.

#### **ASIAN AND AFRICAN LANGUAGES AND LITERATURE**

**299. Asian and African Languages and Literature.** Graduate credit for a course in any of the following languages: Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, Swahili. 3 units. *Staff*

#### **HINDI**

##### **Courses Currently Unscheduled**

**200, 201. Special Studies in South Asian Languages**

## JAPANESE

**205, 206. Discussion of Readings.** Discussion on a variety of topics based on original materials. Prerequisite: Japanese 184 or equivalent. 3 units each. *Staff*

**291. Research Methods in Japanese.** Introduction of various research approaches to literary, sociological, and historical studies of Japan. Emphasis on ensuring that students become fully aware of bibliographical sources that best serve needs in chosen area of specialization. C-L: Cultural Anthropology 290 and History 292. 3 units. *Staff*

## Biochemistry

Professor Raetz, *Chair* (255 Nanaline H. Duke); Professor Greenleaf, *Director of Graduate Studies* (138 Nanaline H. Duke); Professors Bennett, Blackshear, Fridovich, Greenleaf, Hill, Hsieh, Kredich, Lefkowitz, Modrich, Rajagopalan, D. Richardson, J. Richardson, Siegel, Spicer, Steege, and Webster; Associate Professors Been, Fierke, Greene, B. Kaufman, and Sage; Assistant Professors Beese, Casey, Garrett, Hellinga, Hershfield, R. Kaufman, and Oas; Professors Emeriti Bernheim, Gross, Guild, and McCarty; Adjunct Professor Bell

Graduate work in the Department of Biochemistry is offered leading to the Ph.D. degree. Preparation for such graduate study may take diverse forms. Undergraduate majors in chemistry, biology, mathematics, or physics are welcome, but adequate preparation in chemistry is essential. Graduate specialization areas include protein structure and function, crystallography and NMR of macromolecules, nucleic acid structure and function, lipid biochemistry, membrane structure and function, molecular genetics, and enzyme mechanisms. The biochemistry department, in cooperation with the University Programs in Genetics and in Cell and Molecular Biology, offers biochemistry students the opportunity to pursue advanced research and study to fulfill the requirements for the Ph.D. degree related to these fields.

**200. General Biochemistry.** An introductory survey of fundamental aspects of biochemistry with emphasis on the structure of macromolecules, mechanism of enzyme action, metabolic pathways, biochemical genetics, and the structure and functions of special tissues. Designed for medical students; graduate students only with consent of instructor. 4 units. *Staff*

**209, 210. Independent Study.** A tutorial designed for students who are interested in either a laboratory or a library project in biochemistry. Credit to be arranged. C-L: Marine Sciences. Variable credit. *Staff*

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Immunology 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

**222. Structure of Biological Macromolecules.** Introduction to the techniques of structure determination by X-ray crystallography and study of some biological macromolecules whose three-dimensional structures have been determined at high resolution. C-L: Molecular Biophysics 222. 2 units. *Richardson*

**224. Biochemistry of Development and Differentiation.** An extension of topics covered in the first semester course, Biochemistry 219. Emphasis on the control of transcription and translation of messenger RNA in mammalian cells. Studies include gene amplification, postsynthetic modifications of chromosomal proteins, as a result of hormone induction. Specific systems will include the development of the mammary gland, the pancreas, and the chick oviduct. 2 units. *McCarty*



**227. Introductory Biochemistry I: Intermediary Metabolism.** Chemistry of the constituents of proteins, lipids, carbohydrates, and nucleic acids and their metabolic interrelationships. Prerequisite: organic chemistry. 3 units. *Hill and staff*

**228. Introductory Biochemistry II.** Structure, function, and biosynthesis of biological macromolecules and regulation of their synthesis. Intermediary metabolism and metabolic utilization of energy. Biochemistry of biological membranes, receptors, and signal transduction via membrane receptors. Prerequisites: organic chemistry and Biochemistry 227. 3 units. *Webster and staff*

**259. Molecular Biology I: Proteins and Enzymes.** Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures, including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, kinetics of enzyme reactions. Prerequisites: biochemistry, organic chemistry, and physical chemistry. C-L: Cell Biology 259, Immunology 259, Microbiology 259, and Molecular Biophysics 259. 3 units. *Fierke and staff*

**265S, 266S. Seminar.** Topics and instructors announced each semester. 2 units or variable. Variable credit. *Staff*

**268. Molecular Biology II: Nucleic Acids.** Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and equivalents of Biochemistry 259 and Cell and Molecular Biology 247, 277, and 278. C-L: Cell Biology 268, Immunology 268, Microbiology 268, and The University Program in Genetics 268. 4 units. *Steege and staff*

**291. Physical Biochemistry.** Basic principles of physical chemistry as applied to biological systems. Topics include thermodynamics, kinetics, statistical mechanics, spectroscopy, and diffraction theory. Concepts discussed in the context of the biochemistry and behavior of biological macromolecules. Emphasis on quantitative understanding of biochemical phenomena, with extensive problem solving as an instructive tool. Prerequisites: undergraduate physical chemistry and one year of calculus. C-L: Molecular Biophysics 291. 3 units. *Oas and staff*

**321. Hormone and Tissue Interactions in Differentiation and Disease.** Hormones and other biochemical signals in regulation of the differentiated state including amino acids, polypeptide and steroid hormone response in insects, snails, and higher vertebrates discussed in terms of biotechnology used to elucidate mechanisms of information transfer and gene control at the chromatin level. Cell-cell, cell-matrix, and hormonal interactions considered as control elements in development and differentiation. Interactions involving cell surface, basal lamina, and extracellular matrix discussed in terms of differentiation of limb bud/pancreas/lymphocyte/and neural tissue. Conferences include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. 2 units. *Kaufman and K. McCarty, Sr.*

**345, 346. Biochemistry Seminar.** Required of all biochemistry students. Credit/no credit. 1 unit each. *Oas*

**417. Cellular Signaling.** See C-L: Cell Biology 417; also C-L: Pharmacology 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

#### **COURSES CURRENTLY UNSCHEDULED**

**232. Extracellular Matrix and Cell Adhesion**

**245L. Macromolecules, Ecology, and Evolution**



276. Comparative and Evolutionary Biochemistry

286. Current Topics in Immunology

296. Biological Oxidations

297. Intermediary Metabolism

299. Nutrition

## Biological Anthropology and Anatomy

Professor Kay, *Chair* (267 Sands); Associate Professor Smith, *Director of Graduate Studies* (270 Sands); Professors Cartmill, Glander, Hylander, Simons, and Terborgh; Associate Professors Roth and Van Schaik; Assistant Professors Bassett, Maas, Pope, and White; Professor Emeritus LaBarre; Associate Professor Emeritus Duke; Adjunct Associate Professor Wright

Students will be accepted for the Ph.D. degree. Admission to the program is not contingent on any particular course of study at the undergraduate level. The goal of the graduate program in biological anthropology and anatomy is to provide students with a broad-based background in organismal biology with which to study the behavior, ecology, and evolution of primates. The three general areas of specialization in the department are: (1) behavior, ecology, and genetics; (2) paleontology, systematics, and evolution; and (3) functional, comparative, and developmental morphology. Students are encouraged to define a course of study that crosses these boundaries and that extends beyond the strict limits of primatology. Research opportunities include behavioral research at the Duke University Primate Center; ecological and behavioral fieldwork in Africa, South America, Asia, and Madagascar; paleontological fieldwork in Africa, South America, North America, and Madagascar; and laboratories in experimental functional morphology and comparative embryology.

Courses of study are tailored to meet individual needs, but all students will be expected to take gross human anatomy, a course in statistics and experimental design, and at least one course in each of the subfields of the department. Students are required to demonstrate a reading knowledge of at least one language other than English. Further details are available in the *Guide to the Graduate Program in Biological Anthropology and Anatomy*, available from the director of graduate studies.

**238S. Functional and Evolutionary Morphology of Primates.** History and functional significance of locomotor and feeding adaptations, craniofacial morphology, sense organs, and reproductive systems in primates, including *Homo sapiens*. Consent of instructor required. Prerequisites: Biological Anthropology and Anatomy 172S or equivalent. 3 units. *Cartmill, Kay, or staff*

**244L, S. Comparative Primate Ecology.** Comparisons of the evolutionary ecology of prosimians, monkeys, and apes. With field methods. Prerequisites: Biological Anthropology and Anatomy 93 and 143 recommended. 3 units. *Glander or White*

**245S. Primate Social Evolution.** Ecological determinants of, and biological constraints on, social strategies and systems. Emphasis on primates. Prerequisites: Biological Anthropology and Anatomy 93; 143, 144L, or 146; or consent of instructor. 3 units. *Van Schaik*

**246. The Primate Fossil Record.** A survey of fossil primates including early humans. The diversity, anatomy, and behavior of primates as related to the origin and spread of past primates. The radiation of each main group of primates in the succession leading to humans illustrated with slides, casts, and fossils. Topics include geochemical dating,

timing of molecular clocks, and various procedures for classifying primates. 3 units. *Simons*

**247. The Hominid Fossil Record.** Origin and successive stages of development of human ancestors. Detailed analysis of adaptive types and cultural developments. Personalities and current controversies in the study of hominid paleontology. Prerequisites: Biological Anthropology and Anatomy 93, 132, or consent of instructor. 3 units. *Simons*

**248S. Evolution of Mammals.** The origin, adaptive radiation, and phylogenetic relationships of mammals, as inferred from the fossil record. Consent of instructor required. 3 units. *Maas*

**249S. Social Behavior and Evolutionary Change.** The influence of social structure on rate and direction of evolutionary change, including speciation, with emphasis on primate social systems. Mating systems, dispersal patterns, and mechanisms of new social group formation examined from the perspective of their effects on the genetic structure of populations, and species radiations. Prerequisites: Biological Anthropology and Anatomy 143, or 144, or 146. 3 units. *Pope*

**250. Biometry.** A practically oriented overview of the statistical analysis of biological data. Topics include data collection and experimental design, methods and techniques of data organization, use of computing programs and packages, applications of appropriate parametric and nonparametric statistical techniques, assumptions and problems encountered with biological data analysis, and interpretation of results. Prerequisites: Mathematics 136, Psychology 117, Sociology 133, Statistics 10D, 110, 112, 114, 213, or equivalent, and consent of instructor required. 3 units. *White*

**280S, 281S. Seminar in Selected Topics.** Special topics in methodology, theory, or area. Consent of instructor required. 3 units each. *Staff*

**287S. Macroevolution.** Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Botany 287S and Zoology 287S. 3 units. *Roth*

**289L. Comparative Mammalian Anatomy.** A practical survey of anatomical diversity in mammals. An emphasis on dissections of a broad variety of mammals. A broader perspective on specific anatomical features provided in the lectures. 3 units. *Staff*

**290. Pattern and Process in Vertebrate Development.** Research results on developmental processes applied to classic problems of comparative vertebrate biology. Specific focus to vary, but to include cell differentiation and migration, induction, cell-cell interaction and cell mechanics as well as craniofacial morphogenesis, development and evolution, developmental constraints and comparative embryology. Prerequisites: course in comparative or human anatomy and consent of instructor. C-L: Zoology 290. 3 units. *Smith*

**292S. Topics in Morphology and Evolution.** Various aspects of vertebrate morphology and evolution, including major historical approaches to the interpretation of morphology; the evolution, development, and function of specific morphological structures; and patterns of vertebrate evolution. Consent of instructor required. 3 units. *Smith*

**301. Anatomy of the Limbs.** The musculoskeletal anatomy of the limbs and limb girdles. Emphasis is on detailed dissection of the extremities, with a minor focus on clinical applications. Course primarily intended for advanced graduate students in physical therapy. Consent of instructor required. 1 to 3 units. Variable credit. *Staff*



**305. Gross Human Anatomy.** Includes complete dissection of a cadaver; laboratory work is supplemented by conferences which emphasize biological and evolutionary aspects. Required of entering graduate students in anatomy; by arrangement, may extend into second semester. Prerequisites: adequate background in biology, including comparative anatomy and embryology and written consent of instructor. 3 units. *Staff*

**312. Research.** Individual investigations in the various fields of biological anthropology and anatomy. Consent of instructor required. Credit to be arranged; maximum 6 units. Variable credit. *Staff*

**313. Anatomy Seminar.** Regular meeting of graduate students and staff in which current research problems in anatomy will be presented. 1 unit. *Staff*

**314. Biological Anthropology Seminar.** Regular meeting of graduate students and staff in which current research problems in biological anthropology will be presented. 1 unit. *Staff*

**334. Topics in Physical Anthropology.** 3 units. *Staff*

**340. Tutorial in Advanced Anatomy.** Topics for intensive reading and discussion will be chosen according to the student's interests, related to basic problems in function of bone and muscle systems, development and differentiation, comparative anatomy at the gross and histological level and vertebrate evolution. Consent of instructor required. Variable credit. *Staff*

**354. Research in Biological Anthropology and Anatomy.** A preceptorial course in various research methods in biological anthropology and anatomy. Consent of instructor required. Credit to be arranged. Variable credit. *Staff*

**393. Independent Study.** Directed reading and research. Consent of instructor required. 3 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**293, 294. Evolutionary Theory**

## Botany

Professor Searles, *Chair* (149 Biological Sciences); Associate Professor Vilgalys, *Director of Graduate Studies* (134 Biological Sciences); Professors Antonovics, Barber, Boynton, Christensen, W. Culberson, Ramus, Reynolds, Schlesinger, Siedow, Stone, Strain, Terborgh, White, and Wilbur; Associate Professors Knoerr and Kohorn; Assistant Professors Clark, Dong, Honma, Kohorn, and Sun; Professors Emeriti Anderson, Billings, Kramer, and Naylor; Research Professor C. Culberson; Associate Research Professor Harris; Adjunct Professor Osmond; Adjunct Associate Professors Funk, Kress, Lacey, Mishler, Wagner, and Zimmer; Adjunct Assistant Professor McDade; Lecturer Bush

Graduate work in the Department of Botany is offered leading to the A.M. (nonthesis), M.S. (thesis), and Ph.D. degrees, although applicants declaring terminal master's objectives are not admitted to the program. Students entering the graduate program in botany normally have a broad background in the botanical or biological sciences supplemented with basic courses in chemistry, mathematics, and physics. Biochemistry and physical chemistry are strongly recommended for students interested in molecular areas, and advanced courses in mathematics are recommended for students in population genetics and ecology. Deficiencies may be corrected by taking appropriate courses during the first year of graduate study. Students in botany may specialize in a wide variety of areas including anatomy; cellular and molecular biology; evolution; developmental, ecological, molecular, organelle, and population genetics; physiology; community, ecosystem, physiological, and population ecology; marine biology; and the



systematics of algae, fungi, lichens, bryophytes, ferns, and flowering plants. Students' programs are tailored to individual needs. A brochure providing detailed information on the botany department is available from the director of graduate studies.

**212L, S. Phycology.** Morphological and ecological characteristics of common freshwater and marine algae and principles of their classification. 3 units. *Searles*

**215. Tropical Ecology.** Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Environment 217 and Zoology 215. 3 units. *Terborgh*

**218L. Barrier Island Ecology.** An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Strong emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Environment 218L and Marine Sciences. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

**220L. Mycology.** Survey of the major groups of fungi with emphasis on life history and systematics. Field and laboratory exercises. 3 units. *Vilgalys*

**224T, 225T. Special Problems.** Students with adequate training may do special work in the fields listed below. Credit to be arranged. 1 to 4 units. Variable credit.

2. Genetics. *Antonovics*
3. Genetics. *Boynton*
4. Ecology. *Christensen*
5. Ecology. *Clark*
6. Lichenology. *W. Culberson*
13. Cell Biology. *Kohorn*
18. Bryology and Systematics. *Mishler*
24. Phycology. *Ramus*
29. Ecology. *Schlesinger*
30. Phycology. *Searles*
31. Physiology. *Siedow*
33. Systematics of Flowering Plants. *Stone*
34. Ecology. *Strain*
38. Mycology and Molecular Systematics. *Vilgalys*
42. Anatomy and Morphology of Vascular Plants. *White*
44. Systematics of Vascular Plants. *Wilbur*
53. Tropical Ecology and Conservation. *Terborgh*
54. Marine Ecology. *Barber*
55. Ecology. *Reynolds*
57. Systematic Botany. *Baldwin*
58. Plant Molecular Biology. *Dong*
60. Plant Molecular Biology. *Sun*
66. Ecology. *Bush*
67. Cell Biology. *Honma*

**229L, S. Paleoecology.** Global change over the last two million years. Prerequisites: two semesters of biology or geology; and one semester each of calculus, chemistry, and physics; or consent of instructors. C-L: Zoology 229L. 3 units. *Bush, Clark, and Livingstone*

**232. Microclimatology.** See C-L: Environment 232. 3 units. *Knoerr*

**234S. Problems in the Philosophy of Biology.** Consent of instructor required. See C-L: Philosophy 234S; also C-L: Zoology 234S. 3 units. *Brandon*

- 237L. Systematic Biology.** Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L and 22L or equivalents. C-L: Zoology 237L. 3 units. *Staff*
- 241. Field Botany.** Identification and recognition of the vascular flora of the Carolinas. Frequent field trips to representative habitats. Prerequisite: introductory plant identification course or consent of instructor. 3 units. *Wilbur*
- 243L. Evolution and Classification of Angiosperms.** Characteristics and phylogenetic relationships of major flowering plant lineages. Emphasis on current literature, rigorous methods, modern controversies, and biological and biogeographic implications of relationships. Prerequisite: Biology 142L or equivalent. 3 units. *Funk, Kress, and Wagner*
- 256L, S. Plant Biosystematics.** Descriptive and experimental procedures used to assess systematic implications of plant evolution. Laboratory, discussion, and field-oriented problems. Prerequisites: basic courses in systematics and genetics. 3 units. *Staff*
- 257L. Molecular Systematics and Evolution.** Descriptive and experimental procedures used to assess evolutionary diversity for analysis of population genetics and systematic relationships. Laboratory problems, discussion, and individual research projects. Prerequisites: basic course work in systematics, evolution, and genetics. 3 units. *Vilgalys*
- 265L. Physiological Plant Ecology.** The physiological approach to interpreting adaptation in plants, with emphasis on terrestrial seed plants. Prerequisites: Biology 110L and 152 or equivalents. 3 units. *Strain*
- 267L. Community Ecology.** Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Zoology 267L. 3 units. *Clark*
- 269. Advanced Cell Biology.** Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Cell Biology 269 and Immunology 269. 3 units. *Siedow and staff*
- 272. Biogeochemistry.** Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. C-L: Geology 272. 3 units. *Schlesinger*
- 283. Molecular Genetics of Organelles.** Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: The University Program in Genetics 283 and Zoology 283. 3 units. *Boynton and Gillham (zoology)*
- 285S. Ecological Genetics.** Interaction of genetics and ecology and its importance in explaining the evolution, diversity, and distribution of plants and animals. Prerequisites: Biology 180 and Botany 286 or equivalents. C-L: The University Program in Genetics. 3 units. *Antonovics*
- 286. Evolutionary Mechanisms.** Population ecology and population genetics of plants and animals. Fitness concepts, life history evolution, mating systems, genetic divergence, and causes and maintenance of genetic diversity. Prerequisites: Biology 21L and 22L, and Biology 180 or equivalents. C-L: The University Program in Genetics 286 and Zoology 286. 3 units. *Antonovics, Rausher, and Uyenoyama (zoology)*



**287S. Macroevolution.** Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biological Anthropology and Anatomy 287S and Zoology 287S. 3 units. *Roth (zoology)*

**295S, 296S. Seminar.** Credit to be arranged. Variable credit. *Staff*

**300. Tropical Biology: An Ecological Approach.** Highly intensive, field-oriented course conducted in Costa Rica under auspices of the Organization for Tropical Studies. For additional information refer to the chapter "Special and Cooperative Programs." 6 to 8 units. Variable credit. *Staff*

**305S, 306S. Plant Systematics Seminar.** Weekly presentation of current research in plant systematics by students, faculty, and invited speakers. 1 unit each. *Vilgalys*

**310S, 311S. Plant Ecology Seminar.** Discussion of current research and literature. 1 unit each. *Staff*

**315S, 316S. Population Genetics Seminar.** Discussion of recent developments in population genetics. Topics include population dynamics, forces affecting gene frequency change, molecular evolution, philosophy of evolutionary biology. Student presentations are integral to the course. 1 unit each. *Antonovics*

**320S, 321S. Systematics Discussion Group.** An informal discussion group. Topics vary from semester to semester; cover systematic and evolutionary biology in the broad sense. 1 unit each. *Staff*

**325S, 326S. Developmental, Cellular, and Molecular Biology Seminar.** Weekly presentations in developmental, cellular, and molecular biology topics by students, faculty, and invited speakers. Consent of instructor required. 1 unit each. *Staff*

**330L. Environmental Monitoring and Instrumentation.** Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Includes laboratory. Offered on demand. C-L: Environment 330L. 4 units. *Knoerr*

**359, 360. Research in Botany.** Individual investigation in the various fields of botany. Credit to be arranged. C-L: Marine Sciences. Variable credit. *All members of the graduate staff*

**399. Special Readings.** Directed readings in advanced topics. Consent of instructor required. Credit to be arranged. Variable credit. *All members of the graduate staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**209L. Lichenology**

**247L. Plant Ecology**

**261. Photosynthesis**

**344. Micrometeorology and Biometeorology Seminar**

#### **RELATED PROGRAMS**

**The University Program in Cell and Molecular Biology.** Cell and molecular biology courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under Cell and Molec-



ular Biology for descriptions of the following courses: 259. Molecular Biology I: Proteins and Enzymes, and 264. Cell and Molecular Biology Seminar.

**The University Program in Genetics.** Genetics courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under the University Program in Genetics for more information.

**The University Program in Marine Sciences.** Interdisciplinary programs emphasizing marine botany are available. Refer to the section on the University Program in Marine Sciences.

**Program in Integrative Biology.** This interdisciplinary program provides selected graduate students with an academic and research environment in which they are encouraged to think broadly and synthetically about problems in biology.

**Program in Tropical Biology.** Fellowships are available for travel and subsistence in field-oriented programs in Central America. Refer to the section on Organization for Tropical Studies in the chapter "Special and Cooperative Programs."

## Business Administration

Professor Keller, *Chair* (219W Fuqua School of Business); Professor Bettman, *Director of Graduate Studies* (429E Fuqua School of Business); Professors R. Ashton, Baligh, Burton, DeSanctis, Fischer, Forsyth, Hsieh, Huber, Hughes, Laughhunn, Lewin, Magat, McCann, Payne, Sheppard, Staelin, Whaley, and Winkler; Associate Professors Anton, A. Ashton, Bansal, Beneish, Boulding, Edell, Harvey, Kouvelis, Kyle, Linville, Maines, Mazzola, McCardle, M. Moore, M. C. Moore, Nau, Sitkin, J. Smith, Sondak, Viswanathan, and Wallace; Assistant Professors Brodt, Carmon, Friedman, Johnson, Li, Ndilikilikisha, Salk, and Wertenbrach; Professor Emeritus Cohen; Research Professors Breeden and Dumas

The Ph.D. in Business Administration program prepares candidates for research and teaching careers at leading educational institutions and for careers in business and governmental organizations where advanced research and analytical capabilities are required. The Ph.D. program places major emphasis on independent inquiry, on the development of competence in research methodology, and on the communication of research results. The student and his/her faculty committee determine the specific program of study. Each student takes a comprehensive examination at the end of the second year or at the beginning of the third year of residence. The final requirement is the presentation of a dissertation. The Ph.D. program usually requires four to five years of work. Refer to the *Bulletin of Duke University: The Fuqua School of Business* for a complete list of courses and course descriptions.

**510. Bayesian Inference and Decision.** Methods of Bayesian inference and statistical decision theory, with emphasis on the general approach of modeling inferential and decision-making problems as well as the development of specific procedures for certain classes of problems. Topics include subjective probability, Bayesian inference and prediction, natural-conjugate families of distributions, Bayesian analysis for various processes, Bayesian estimation and hypothesis testing, comparisons with classical methods, decision-making criteria, utility theory, value of information, and sequential decision making. C-L: Statistics 221. 3 units. *Winkler*

**513. Choice Theory.** This seminar deals with the topics of measurement theory, conjoint measurement, expected utility and subjective expected utility theory, multi-attribute utility theory and recent advances in preference modeling (generalized non-linear utility theories). The goal of this seminar is to equip students with tools so that

they can use preference modeling in a wide variety of social science applications. C-L: Statistics 234. 3 units. *Staff*

**521. Organization Seminar: A Micro Focus.** Individual and small group behavior in organizations. Theories of motivation, decision making, interpersonal behavior, group processes, and leadership. A variety of research approaches and methods includes presentation of behavioral research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

**522. Organization Seminar: A Macro Focus.** The organization and the subunits which make up the organization. Theories of organization, structure, decentralization, divisionalization, functional area integration, task design, incentives and rewards, information systems, and decision rules are developed with an orientation toward their choice and design for high performance. Includes presentation of research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

**525. Behavioral Decision Theory.** Examines the development of research in individual and group decision behavior. Major emphasis is given to theoretical developments and empirical research, with a range of articles assigned for each topic. The basic topic areas include (1) decision problem structuring, (2) thinking about uncertainties, (3) risk taking, (4) dealing with conflicting values, and (5) combining individual judgments into a group decision. C-L: Psychology: Experimental 316, Psychology: Social and Health Sciences 316, and Statistics 231. 3 units. *Payne*

**531. Financial Accounting Seminar.** The nature of published financial statement information and its relationship with various economic variables. The list of related variables might include stock market data, bankruptcy filings, and the actions of various users of financial statement information, including management, investors, creditors, and regulators. The focus is on the current research methodologies and research efforts used to analyze the above relationships. A background in masters-level accounting and finance is assumed. 3 units. *Staff*

**532. Management Accounting Seminar.** Information systems and their use in facilitating management decision making and organizational control. Emphasis on the appropriate research methodologies and paradigms including information economics, decision theory, and organizational theory. Topics include budgeting, incentive systems/performance evaluation, variance investigation, and cost allocation. 3 units. *Staff*

**551. Finance Theory I.** Mathematical derivation of important results in portfolio theory and asset-pricing models in finance. Topics include: single-period mean-variance efficient portfolios and the CAPM; pareto optimal allocations; multiperiod and continuous-time optimal consumption and portfolio rules; intertemporal asset-pricing model; arbitrage pricing theory; and the term structure of interest rates and inflation risk. Prerequisites: basic mathematics background in calculus, statistics, matrix algebra, optimization, and dynamic programming. 3 units. *Kyle or Viswanathan*

**552. Empirical Finance.** Overview of current empirical methods used in financial economics research. Topics include: univariate and multivariate tests; linear versus nonlinear models; conditional versus unconditional tests; asymptotic theory, generalized method of moments; and the size and power of test statistics. Testing procedures are applied to asset pricing theory, corporate finance, and option pricing theory problems. Prerequisite: Ph.D. level course in econometrics; recommended: Business Administration 551. 3 units. *Bansal*

**553. Finance Theory II.** Mathematical derivation of well-known models in informational economics, market microstructure, and option pricing. Topics include: models of rational expectations, signaling models, principal-agent, and auctions. Market microstructure and advanced option pricing applications are stressed. This course may be



taken concurrently with Business Administration 551. Prerequisites: basic mathematics background in calculus, statistics, matrix algebra, optimization, and dynamic programming. 3 units. *Staff*

**561. Seminar in Quantitative Research in Marketing.** An overview of the quantitative techniques which are important in marketing research. Each model and technique will be examined in considerable detail so as to permit an understanding of its assumptions, structure, and usefulness. Topics covered will include the general data analysis techniques as well as models from advertising, new products, and pricing decisions. 3 units. *Staff*

**562. Seminar in Consumer Behavior.** Examines the development of research in consumer behavior. Major emphasis is given to theoretical developments and empirical research, with a range of articles assigned for each topic. Topics include motivation and personality, perceptual processes, information search, choice processes, attitudes and persuasion, learning, and influence in consumer choice. C-L: Psychology: Experimental 315 and Psychology: Social and Health Sciences 315. 3 units. *Bettman*

**563. Marketing Models Seminar.** The primary goals of this seminar are (a) to critically review the most current research in marketing and (b) to gain a better understanding of and ability to build one's own model. After taking this course, students should be able to understand the assumptions and mathematical development of the current quantitative work in marketing and to use this understanding to develop meaningful extensions. 3 units. *Staelin*

**564. Experimental Design and Analysis Seminar.** Examines issues in the design and analysis of experiments. Emphasis on analysis of variance (ANOVA), starting with the basic ANOVA model and examining multiple factor designs, blocking designs, nested models, within subject designs, repeated measure designs, and analysis of covariance. 3 units. *Edell*

**571. Operations Strategy Seminar.** Recent developments in the strategy of operations in both the manufacturing and service sectors. Topics include the focused factory concept, Japanese manufacturing philosophy, technological policy toward new process development and toward new product introduction, vertical integration, choice of capacity and location, industry analysis, and the impact of government regulation. Emphasis on the development of hypotheses about strategic topics and the empirical means by which they can be tested. 3 units. *Staff*

**572. Seminar in Operational and Technological Tactics.** Current issues in the day-to-day management of manufacturing and service delivery systems. Topics include material requirements planning, capacity requirements planning, quality of work life projects, productivity measurement and enhancement, implementation of new product introductions and production process modifications, quality assurance, production planning and scheduling, and logistics. Concentration on the substance of recent developments, the generation and test of hypotheses about tactical issues, and the applicability of various optimization techniques to the advance of operation tactics. 3 units. *Staff*

**591. Selected Topics in Business.** Allows the doctoral student the opportunity to study special topics in management on an occasional basis depending on the availability and interests of students and faculty. 3 units. *Staff*

**597. Dissertation Research.** For students actively pursuing research on their dissertation. Credit to be arranged. Prerequisites: student must have passed the preliminary examination and have the consent of the director of the doctoral program and instructor. Variable credit. *Staff*



**598. Independent Study.** Allows the doctoral student the opportunity to engage in study or tutorial on special topics on an individual basis under the supervision of a faculty member. Credit to be arranged. Prerequisites: doctoral program standing and consent of the director of the doctoral program and instructor. Variable credit. *Staff*

**599. Directed Research.** Allows the doctoral student to engage in individual research projects under the supervision of a faculty member. Credit to be arranged. Prerequisites: doctoral program standing and consent of the director of the doctoral program and instructor. Variable credit. *Staff*

## The University Program in Cell and Molecular Biology

Professor McClay, *Director* (zoology); Assistant Professor Salvesen, *Associate Director* (pathology); Associate Professor Kreuzer, *Director of Graduate Studies*; Professors Caron (cell biology), Joklik (microbiology), Siedow (botany), and Webster (biochemistry); Associate Professors Kuhn (pharmacology) and Skene (neurobiology); Assistant Professor Doyle (immunology)

A complete list of faculty, including research interests, will be made available to prospective students.

Research training in cell, developmental, and molecular biology is found in eleven departments/programs at Duke University: biochemistry, botany, cell biology, genetics, immunology, microbiology, molecular cancer biology, neurobiology, pathology, pharmacology, and zoology. To effectively utilize this broad spectrum of expertise for the training of promising scientists while still providing a coherent curriculum, the Duke University Program in Cell and Molecular Biology has been established.

During the first semester of doctoral study a student will complete the program's six half-semester "mini-course" sequence. This sequence presents a broad-based approach to key areas of contemporary cell and molecular biology, including macromolecular synthesis, structure of macromolecules, genetic analysis, cell biology, modern techniques in molecular biology, and physical chemistry for biologists. Particularly in the second and third semesters, each student will also choose elective courses in an area of specialization. Research training is stressed throughout the program and dissertation research usually begins by the third semester. Prospective students may apply directly to the Cell and Molecular Biology Program or to one of the eleven participating departments/programs. Applicants must have demonstrated, in addition to overall academic excellence, a proficiency in the biological and physical sciences. Applications for admission and fellowship support must be received by December 31, but early applications may receive advanced consideration.

**247. Macromolecular Synthesis.** Fundamentals of DNA replication, transcription, and translation. Transcriptional and translational regulation mechanisms. Consent of instructor required for undergraduates. First half of fall semester. C-L: The University Program in Genetics 247. 2 units. *Garcia-Blanco and Keene*

**248. Cell Biology.** Cellular compartments, protein trafficking, cytoskeleton, chemical signalling, cell division, adhesion. Consent of instructor required for undergraduates. Second half of fall semester. C-L: The University Program in Genetics 248. 2 units. *Bennett and Sheetz*

**251. Molecular Cell Biology.** See C-L: Cell Biology 251. 4 units. *Erickson and staff*

**264. Cell and Molecular Biology Colloquium.** Required of all students. Third- and fourth-year students discuss their dissertation research. 1 unit. *Kreuzer*

**277. Structure of Macromolecules.** Structure of biological macromolecules (proteins and nucleic acids) and the relationship of structure to function and catalysis.

Consent of instructor required for undergraduates. First half of fall semester. C-L: The University Program in Genetics 277. 2 units. *Beese and White*

**278. Genetic Analysis.** Consent of instructor required for undergraduates. See C-L: The University Program in Genetics 278. 2 units. *Garrett and Steege*

**297. Modern Techniques in Molecular Biology.** Discussions of nucleic acid sequencing and manipulation, cloning strategies, vectors, expression, hybridization and blotting methods, PCR, etc. Consent of instructor required for undergraduates. Second half of fall semester. 2 units. *Casey and Fehon*

**298. Physical Chemistry for Biologists.** Thermodynamics and kinetics using biological examples; spectroscopy (for example, NMR, UV, CD). Consent of instructor required for undergraduates. Second half of fall semester. 2 units. *Hammes and Spicer*

## Cell Biology

Professor Sheetz, *Chair*; Professor Erickson, *Director of Graduate Studies*; Professors V. Bennett, Blum, C. Bonaventura, J. Bonaventura, Caron, Gutknecht, Hatchell, Jöbsis, Johnson, Lieberman, Mandel, McIntosh, McManus, Nicklas, Padilla, Plonsey, Reedy, Somjen, Sommer, and Spach; Associate Professors Akwari, N. Anderson, P. Bennett, Cobb, Corless, Greenfield, Kiehart, Mills, Schachat, Schomberg, Stolp, Vigna, and Wright; Assistant Professors P. Anderson, Argon, Benjamin, Capel, Cohn, Davis, DeLozanne, Dittman, Drezner, Fehon, Freemark, Freudenrich, Garrett, Hannun, Iglehart, Kindman, Kraus, Lin, Mangel, Marchuck, Meyer, Nicchitta, Obeid, O'Halloran, Saling, Sladen, Swenson, Titus, and Webb; Professors Emeriti Counce and Moses; Associate Medical Research Professors Aitken and LeFurgey; Assistant Medical Research Professors Chang, Klitzman, Lobaugh, and O'Brien; Adjunct Professor Rodbell; Adjunct Assistant Professor Carter

The Department of Cell Biology offers graduate training in modern cell biology and physiology leading to the Ph.D. degree.

Specific research interests include: cytoskeleton and cell motility, including both actin and microtubule based motors, mechanisms of contraction, vesicle transport and chromosome movement; cardiac and skeletal muscle, including ultrastructure, physiology, developmental and molecular biology; cell adhesion and biophysics of membrane interactions; extracellular matrix; protein secretion and trafficking mechanisms; transmembrane receptors and molecular mechanisms of signal transduction; cell physiology, metabolism, and membrane transport in brain, kidney, muscle; vertebrate photoreceptors; high resolution electron microscopy and computer image processing; and developmental biology using mouse and drosophila.

The department has excellent facilities for light and electron microscopy; X-ray diffraction; cell culture and micromanipulation; and modern biochemistry and molecular biology. The Department of Cell Biology also participates in several university-wide interdisciplinary training programs, including genetics, cell and molecular biology, neurobiology, pharmacology, biomedical engineering, and toxicology.

The Division of Physiology, which is centered in the Department of Cell Biology, brings together faculty and students with interests in cellular, organ, and systemic physiology. The program of graduate studies in physiology is organized through this division. The Division of Developmental Biology focuses research and teaching on mechanisms of development. Mouse and drosophila developmental systems are studied using modern approaches of genetics and molecular biology. For further information, contact the director of graduate studies.

**200. Cell and Tissue Biology.** Lectures on the structure and function of the cells and tissues of the body. The laboratory provides practical experience with light microscopy studying and analyzing our extensive slide collection of mammalian tissues. Designed



for medical students; graduate students may take this course with consent of instructor. Fall. 3 units. *McIntosh and staff*

**201. Microscopic Anatomy.** Histology of all the major organs of the body. Structure and cell biology at both the light and electron microscope levels. Laboratory sessions are used to study and analyze our extensive slide collection of mammalian tissues with light microscopes. Designed for medical students; graduate students accepted with consent of instructor. Prerequisite: Cell Biology 200. 3 units. *McIntosh and staff*

**202. Medical Physiology.** Lectures and conferences on cell and organ physiology. Human and medical aspects are stressed in clinical conferences. Computer-based laboratory exercises. Designed for medical students; graduate students only with consent of instructor. Students may take either 202 or 203 and 204, but not both, for credit. Fall. Prerequisite: Cell Biology 200. 4 units. *N. Anderson and staff*

**203. Introduction to Physiology.** Modern organ physiology: cellular physiology, the heart and cardiovascular system, the respiratory system, the kidney, the gastrointestinal, endocrine, and nervous systems. Prerequisite: elementary biology. 4 units. *Blum and staff*

**204. Cell and Molecular Physiology.** Selected aspects illustrating the use of cellular and molecular approaches to the understanding of physiological organ functions. Topics include: molecular basis of contraction and muscle diversity, cell-cell interactions through cell junctions, paracrine or hormonal signals, signal transduction, molecular basis of channel and carrier functions, physiology of transgenic mice. Prerequisite: Cell Biology 203 or cell biology. 3 units. *Mandel and staff*

**205. Design and Analysis of Biological Experiments.** An introductory-level course for individuals engaged in or planning research projects in life sciences. Emphasis is on developing an adequate background in the fundamentals of probability, statistics, and hypotheses testing, and the application of those principles to commonly encountered research situations. The course will include lectures, hands-on use of the Statistical Analysis System (SAS) computer package for data analysis, and critical evaluation of experimental designs employed in representative studies from the literature. 3 units. *Lobaugh*

**208. Cellular Neurobiology.** Consent of instructor required. See C-L: Neurobiology 208. 3 units. *Augustine, Kauer, and Reinhart*

**210. Independent Study.** Directed reading and study in cell biology/physiology. Descriptions of specific areas may be obtained from the director of graduate studies. Consent of director of graduate studies required. 3 to 9 units each. C-L: Marine Sciences. Variable credit. *Staff*

**211. Cellular Mechanisms of Injury.** Selected topics in mechanisms of injury at the cellular and molecular levels chosen for reading and discussion in a combined lecture/seminar format. Subject matter varies each semester; can be taken more than once. Consent of instructor required. 3 units. *Fridovich, LeFurgey, Lieberman, Mandel, Steenberg, and guest faculty*

**212. Topics in Reproductive Biology.** An in-depth, integrative study of male and female reproduction, including (i) hypothalamic, pituitary, and gonadal control mechanisms, (ii) gamete structure and development, (iii) fertilization, and (iv) pregnancy and parturition. Guest lectures will emphasize the interface between basic, veterinary, and medical sciences. Prerequisite: Cell Biology 269 or equivalent. 3 units. *N. Anderson, Saling, Schomberg, or Tyrey*

**213. Oxygen and Physiological Function.** The sensitive dependence of many physiological functions on cellular oxidative metabolism. The delicate balance between



the oxygen toxicity of hyperoxia and the consequences of hypoxia will be explored from organ malfunction to cell death. Prerequisite: an introductory course in physiology or biochemistry or consent of instructor. 2 units. *Jöbsis*

**219. Molecular and Cellular Bases of Differentiation.** A multidisciplinary approach stressing the molecular, cellular, and genetic processes involved in differentiation in eukaryotes. C-L: Biochemistry 219, Immunology 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

**223. Cellular and Integrative Cardiovascular Physiology and Biophysics.** Electrical and mechanical properties of the heart at the cellular and organ levels; reflex control of cardiac output; the heart as an endocrine organ; interaction between heart, kidney, and lung; comparative cardiac physiology. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent; consent of instructor or graduate status. C-L: Biomedical Engineering 223. 3 units. *Benjamin and staff*

**237. Analytical Imaging in Biomedical Research.** Weekly seminars to discuss concepts and techniques in high resolution analytical imaging of cells and subcellular organelles and to review application of these concepts to structural-functional correlations in cell physiology and pathophysiology. 3 units. *LeFurgey*

**243. Environmental Biochemistry.** Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 243 and Marine Sciences. 3 units. *C. Bonaventura*

**244L. Cellular and Molecular Research Techniques.** Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium, assays, rapid reaction kinetics, microscopy, molecular graphics, and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. Includes laboratory. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 244L and Marine Sciences. 4 units. *C. Bonaventura and Brouwer*

**251. Molecular Cell Biology.** Current research topics in cell biology presented in a lecture and discussion format based on recent research papers. Topics include: protein secretion and trafficking; mitochondria and organelles; the nucleus; cytoskeleton and cell motility; extracellular matrix and cell adhesion; growth factors and signalling; cell cycle. C-L: Cell and Molecular Biology 251. 4 units. *Erickson and staff*

**259. Molecular Biology I: Proteins and Enzymes.** Prerequisites: biochemistry, organic chemistry, and physical chemistry. See C-L: Biochemistry 259; also C-L: Immunology 259, Microbiology 259, and Molecular Biophysics 259. 3 units. *Fierke and staff*

**263. Molecular Genetics of Drosophila Development.** Discussion of recent developments in the genetic and molecular analysis of Drosophila development. Topics include morphogenesis, neurogenesis, embryonic patterning, and cellular interactions. Student presentations are integral to the course. Consent of instructor required. C-L: The University Program in Genetics 263 and Zoology 263. 2 units. *Fehon, Kiehart, and Wharton*

**268. Molecular Biology II: Nucleic Acids.** Prerequisites: introductory biochemistry and equivalents of Biochemistry 259 and Cell and Molecular Biology 247, 277, and 278. See C-L: Biochemistry 268; also C-L: Immunology 268, Microbiology 268, and The University Program in Genetics 268. 4 units. *Steege and staff*

**269. Advanced Cell Biology.** Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Botany 269 and Immunology 269. 3 units. *Siedow and staff*

**280. Student Seminar.** Preparation and presentation of seminars to students and faculty on topics of broad interest to cell biology and physiology. Required of Department of Cell Biology students. 1 unit. *Staff*

**293. Membrane Biophysics.** See C-L: Molecular Biophysics 293. 3 units. *McIntosh and staff*

**301. Introduction to Cell and Molecular Biology.** Three weeks of intensive laboratory exercises utilizing modern techniques of gene cloning; PCR; protein expression and purification; light and electron microscopy. Laboratory work will be supplemented with lectures and discussion groups. Course begins two weeks prior to the opening of the semester. 1 unit. *Titus and staff*

**312. Research.** Specific areas of investigation include: membrane structure; extra-cellular matrix; cell adhesion; cell motility; cytoskeletal elements; chromosome structure and movement; genetics and molecular biology of contractile proteins; muscle ultra-structure; gamete biology; molecular and structural biology of photoreceptors; hormone receptors; cell growth; developmental biology; membrane transport and electrophysiology; metabolism; cardiovascular physiology; microcirculation; hyperbaric physiology; and theoretical studies and computer modeling of physiological processes. Variable credit. *Staff*

**320. Research Problems in Cell Biology.** Coverage of selected topics important in current cell biology research. Format includes faculty lectures and directed readings of current research papers presented and discussed by students. 3 units. *Sheetz and staff*

**417. Cellular Signaling.** Mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanisms of regulation of hormone responsiveness, regulation of growth, differentiation and proliferation, mechanisms of transport and ion channels, stimulus sensing and transduction. Some lectures stress the clinical correlation of the basic course concepts. C-L: Biochemistry 417 and Pharmacology 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

## **COURSES CURRENTLY UNSCHEDULED**

**215. Seminar in the Physiology of Disease**

**217. Selected Membrane Transport**

**232. Extracellular Matrix and Cell Adhesion**

**235. Advanced Research Training in Marine Molecular Biology and Biotechnology**

**235L. Advanced Research Training in Marine Molecular Biology and Biotechnology**

**236S. Seminar on the Cellular and Molecular Biology of Skeletal Muscle**

**270S. Molecular and Cellular Adaptations of Marine Organisms**

**305. Selected Topics in Cardiac Physiology**

## **Chemistry**

Professor Crumbliss, *Chair* (101 Gross Chemical Laboratory); Professor McGown, *Director of Graduate Studies* (329 Gross Chemical Laboratory); Professors Baldwin, Bonk, Chesnut, Fraser-Reid, Lochmüller, McPhail, Palmer, Porter, Shaw, Smith, and Wells;



Associate Professors Henkens, MacPhail, and Pirrung; Assistant Professors Burk, Coury, Prisant, Toone, and Yang; Professors Emeriti Arnett, Bradsher, Brown, Hobbs, Poirier, Quin, Strobel, and Wilder; Adjunct Professors Andrews, Chao, Ghirardelli, Spielvogel, and Sternbach

In the Department of Chemistry graduate work is offered leading to the M.S. and Ph.D. degrees. Before undertaking a graduate program in chemistry, a student should have taken an undergraduate major in chemistry, along with related work in mathematics and physics. Graduate courses in the department are offered in the fields of analytical, biological, inorganic, organic, and physical chemistry. Research programs are active in all these fields. A booklet providing detailed information on the department is available from the director of graduate studies.

#### **For Seniors and Graduates**

**201. Molecular Spectroscopy.** Selected spectroscopic methods in the study of molecular structure. Symmetry and group theoretical basis for selection rules, theories of magnetic and optical resonance, and interpretation of spectra; examples from both inorganic and organic chemistry. Three lectures. Open to especially well-prepared undergraduates by consent of director of undergraduate studies. 1 to 3 units. Variable credit. *Baldwin, Fraser-Reid, Palmer, Pirrung, Prisant, and Smith*

**203. Quantum Chemistry.** Basic principles of quantum and group theoretical methods. Topics include symmetry and a review of the fundamentals and the mathematical foundations of quantum theory. Emphasis on the application of molecular orbital theory to organic and inorganic systems. Open to especially well-prepared undergraduates by consent of director of undergraduate studies. 1 to 3 units. Prerequisite: Chemistry 162L. Variable credit. *Chesnut, MacPhail, and Porter*

**205. Structure and Reaction Dynamics.** Structure and mechanisms in organic and inorganic compounds, substitution reactions, linear free energy relations, and molecular rearrangements. Emphasis on the use of kinetic techniques to solve problems in reaction mechanisms. Three lectures. Open to especially well-prepared undergraduates by consent of director of undergraduate studies. 1 to 3 units. Variable credit. *Crumbliss, Porter, Toone, and Wells*

**207. Principles of Kinetics, Thermodynamics, and Diffraction.** Three lectures. Open to especially well-prepared undergraduates by consent of director of undergraduate studies. 1 to 3 units. Variable credit. *McPhail, Prisant, Smith, and Yang*

**275, 276. Advanced Studies.** (1) Analytical chemistry, (2) inorganic chemistry, (3) organic chemistry, and (4) physical chemistry. Open to especially well-prepared undergraduates by consent of director of undergraduate studies. 3 units each. *Staff*

#### **For Graduates**

**300. Basic Statistical Mechanics.** Fundamentals of quantum and classical statistical mechanics using the ensemble approach. Emphasis on systems of weakly interacting particles with internal degrees of freedom. 3 units. *Staff*

**302. Basic Quantum Mechanics.** The fundamentals of quantum mechanics with special emphasis on chemical applications. Topics included are: linear algebra, the uncertainty relations, angular momentum, perturbation theory and time dependent phenomena, molecules in electromagnetic fields, group methods, and electron correlation. 3 units. *Staff*

**303, 304. Special Topics in Physical Chemistry.** Presentation of one or more topics of staff interest such as advanced methods in crystallography, light scattering and small angle X-ray diffraction, application of ESR spectroscopy to chemical problems, elec-



tronic spectroscopy of proteins, group theory, intermolecular forces, liquid crystals, methods of determining the rates of elementary steps in reaction kinetics, physical chemistry of aerosols, physical-chemical methods of polymer characterization, structure and bonding in metallo-enzymes, statistical mechanics of fluids, topics in structural chemistry, and triplet excitons. 1 to 3 units each. Variable credit. *Staff*

**306. Biophysical Chemistry.** The interrelationships between structure, function, and mechanisms of biological macromolecules. Principles of dynamics (including kinetics, reactivity, and transport) and structure (including thermodynamics, NMR, fluorescence, CD spectroscopy, and other applicable biophysical techniques). 2 to 3 units. Variable credit. *Henkens or Shaw*

**310. Electronic Structure and Spectroscopy of Transition Metal Compounds.** The theory of ligand fields and its application to the electronic spectroscopy, electron spin resonance, and magnetism of transition metal compounds. 2 units. *Palmer*

**312. Chemistry of the Main Group Elements.** Preparations, bonding, structures, and reactivity of compounds of the main group elements with emphasis on members of the *p* block groups. 3 units. *Crumbliss and Wells*

**313. Special Topics in Inorganic Chemistry.** Lectures, oral reports, and discussions on advanced topics and recent advances in the field of inorganic chemistry. Examples of topics which may be discussed are bioinorganic chemistry, fluxional molecules, homogeneous catalysis, synthesis and properties of selected groups of compounds, and new physical methods. 1 to 3 units. Variable credit. *Staff*

**314. Advanced Inorganic Reaction Mechanism.** A discussion of the mechanism of coordination and organometallic reactions in solvent solution. Examples include redox reactions and linear free energy relationships. Consent of instructor required. 2 units. *Crumbliss*

**320. Synthetic Organic Chemistry.** A study of the scope and limitations of the more important types of reactions in synthetic organic chemistry. Some discussion of the rapidly developing use of transition metals, complex hydrides, and photochemistry will be included. 3 units. *Baldwin or Fraser-Reid*

**322. Organic Reactive Intermediates.** A discussion of reactive intermediates in organic chemistry. Topics will include carbanions, carbenes, carbonium ions, free radicals, photochemical excited states, and other reactive species. 3 units. *Porter*

**324. Special Topics in Organic Chemistry.** Advanced topics and recent developments in the field of organic chemistry. Representative topics include heterocyclic chemistry, natural products chemistry, carbohydrate chemistry, molecular mechanics, and two-dimensional NMR spectroscopy. Lectures and written and oral reports. 1 to 3 units. Variable credit. *Staff*

**326. Bioorganic Chemistry.** An investigation of biochemical principles from the viewpoint of the organic chemist. Fundamental and applied enzymology, enzyme inhibition, enzyme models, biosynthetic pathways, methodology for the study of biological transformations, molecular biology for organic chemists. 3 units. *Pirrung and Toone*

**330. Separation Science.** Section .01, fundamental separation chemistry; section .02, practical aspects of chromatographic methods; section .03, larger scale processes. 1 to 3 units. Variable credit. *Lochmüller*

**331, 332. Special Topics in Analytical Chemistry.** An advanced treatment of important areas in modern analysis. Possible topics include: electrochemistry, small com-

puter applications, magnetic resonance, and problem-solving approaches. 1 to 3 units each. Variable credit. *Staff*

**334. Electroanalytical Chemistry.** Fundamentals and applications of techniques for probing heterogeneous charge transfer reactions, including cyclic voltammetry at conventional and ultra micro electrodes. 2 units. *Coury*

**336. Analytical Spectroscopy.** Fundamentals of atomic and molecular spectroscopies for chemical analysis, emphasizing absorption, emission, and luminescence techniques. 2 units. *McGown*

**373, 374. Seminar.** One unit is required of all Ph.D. candidates in chemistry. One hour a week discussion. 1 unit each. *All members of the graduate staff*

**375, 376. Research.** Instruction in methods used in the investigation of original problems. Individual work and conferences. 1 to 6 units each. Variable credit. *All members of the graduate staff*

**377. Research Orientation Seminar.** A survey of departmental research. Required of all entering graduate students in chemistry. Consent of director of graduate studies required. 1 unit. *All members of the graduate staff*

## Classical Studies

Professor Clay, *Chair* (237 Allen); Professor Oates, *Director of Graduate Studies* (229A Allen); Professors Connor, Davis, Newton, Stanley, and Younger; Associate Professors Boatwright, Burian, and Riggsby; Assistant Professors Cormack and Janan; Professors Emeriti Richardson and Willis; Research Associate van Minnen

The Department of Classical Studies offers graduate work leading to the A.M. and Ph.D. degrees in classical studies. Work in the department encompasses all aspects of the Greco-Roman world: students in the program are able, through course work, directed research, and their own teaching, to prepare for careers of teaching and research as broadly trained classical scholars. For regular admission, students should offer at least three years of college study in one of the classical languages and two in the other. Before developing a specialization within the program, students are expected to acquire facility in both Greek and Latin, a broad knowledge of the literatures and of ancient history and archaeology, and command of research methods. Reading knowledge of French and German is required for the Ph.D. The resources of the department include important collections of Greek and Latin manuscripts and papyri, computer facilities in the ancient languages, and a valuable study collection of Greek and Roman art. The journal *Greek, Roman, and Byzantine Studies* is published at Duke. The director of graduate studies will provide on request a brochure giving further information about the department's requirements, resources, and financial aid; prospective students should also consult the general requirements of the university set forth in the chapter on "Registration" in this bulletin.

### GREEK

#### For Seniors and Graduates

**200. Readings in Greek Literature.** 3 units. *Staff*

**201. Studies in Greek Literature I.** 3 units. *Staff*

**202. Studies in Greek Literature II.** 3 units. *Staff*

**203. Homer.** Problems of language and structure in the *Iliad*; present state of Homeric scholarship. 3 units. *Burian or Stanley*

**205. Greek Lyric Poets.** Fragments of the early lyric poets; selected odes of Pindar and Bacchylides. 3 units. *Burian or Stanley*

**207. The Dramatists.** Readings and studies of selected plays by the major playwrights Aeschylus, Sophocles, Euripides, and Aristophanes. 3 units. *Burian*

**222. The Historians.** Readings and studies in the major Greek historians Herodotus, Thucydides, and Xenophon. 3 units. *Connor or Oates*

#### **For Graduates**

**301. Seminar in Greek Literature I.** Selected authors and topics. 3 units. *Burian, Clay, or Stanley*

**302. Seminar in Greek Literature II.** Selected authors and topics. 3 units. *Burian, Clay, or Stanley*

**313. Seminar in Greek Epigraphy.** 3 units. *Rigsby*

**399. Directed Reading and Research.** Credit to be arranged. Variable credit. *Staff*

#### **Courses Currently Unscheduled**

**209. Introduction to Hellenistic Literature**

**210. Alexandrian Poetry**

**221. Early Greek Prose**

**226. The Orators**

**321. Seminar in Literary Papyri**

#### **LATIN**

##### **For Seniors and Graduates**

**200. Readings in Latin Literature.** 3 units. *Staff*

**201. Studies in Latin Literature I.** 3 units. *Staff*

**202. Studies in Latin Literature II.** 3 units. *Staff*

**205. The Roman Novel.** Readings in Petronius and Apuleius. 3 units. *Davis, Richardson, or Stanley*

**206S. Cicero.** 3 units. *Richardson*

**207S. Vergil's *Aeneid*.** Intensive analysis of all of Vergil's *Aeneid*, focusing on text and historical context, complemented by research papers and reports. Not open to students who have taken Latin 107S. 3 units. *Davis or Newton*

**208S. Lyric and Occasional Poetry.** Readings in the works of Catullus, Horace, and Martial. Same as 108S, except additional term paper required. 3 units. *Davis, Janan, or Newton*

**211S. Elegiac Poets.** Analysis of most of the *corpora* of Propertius, Tibullus, and Ovid with close attention to the stylistics of the poems, their place in the traditions of Latin love elegy, and their relation to other phenomena of the Augustan period. Not open to students who have taken Latin 111S. 3 units. *Davis, Janan, or Richardson*

**214S. The Historians.** Investigations of the Romans' conceptions and practices of writing history, based on detailed analysis of the works of Sallust, Livy, and Tacitus. Additional readings in the fragments of other Latin historians, and in comparative Greek



historians. Not open to students who have taken Latin 114S. 3 units. *Boatwright or Richardson*

**217T. Latin Prose Composition.** The course content is determined by the needs of the students enrolled. 3 units. *Staff*

**221. Medieval Latin.** Selected works of the Latin Middle Ages from Prudentius to the humanists. Genres studied usually include the hymn, sequence, drama, lyric, saints' lives, chronicle, epic, and epistle. C-L: Medieval and Renaissance Studies. 3 units. *Newton*

### For Graduates

**301. Seminar in Latin Literature I.** Selected authors and topics. 3 units. *Boatwright, Davis, Janan, or Newton*

**302. Seminar in Latin Literature II.** Selected authors and topics. 3 units. *Boatwright, Davis, Janan, or Newton*

**312. Seminar in Latin Palaeography.** 3 units. *Newton*

**399. Directed Reading and Research.** Credit to be arranged. Variable credit. *Staff*

### Courses Currently Unscheduled

**204. Epic of the Silver Age**

**314. Seminar in Latin Epigraphy**

**315. Seminar in Roman Law**

## CLASSICAL STUDIES

### For Seniors and Graduates

**203. Ancient Political Philosophy.** See C-L: Political Science 223. 3 units. *Gillespie or Grant*

**211S. Plato.** Selected dialogues. C-L: Philosophy 211S. 3 units. *Ferejohn*

**217S. Aristotle.** Selected topics. C-L: Philosophy 217S. 3 units. *Ferejohn*

**220S. Topics in Greek Art.** Consent of instructor required. See C-L: Art 201S. 3 units. *Cormack*

**222. Fifth and Fourth Century Greece.** From the Persian Wars to the dominance of Philip of Macedon. C-L: History 260. 3 units. *Oates or Rigsby*

**224. The Roman Republic.** The rise of Rome, to its mastery of the Mediterranean; the political, social, and intellectual consequences. C-L: History 263. 3 units. *Boatwright or Rigsby*

**225. The Roman Empire.** The foundation, consolidation, and transformation of Roman rule from Augustus to Diocletian. C-L: History 264. 3 units. *Boatwright*

**227S. Topics in Roman Art.** Consent of instructor required. See C-L: Art 202S. 3 units. *Cormack*

**230S. Topics in Early Christian and Byzantine Art.** Consent of instructor required. See C-L: Art 233S; also C-L: Medieval and Renaissance Studies and Religion 275S. 3 units. *Wharton*

**231S. Greek Sculpture.** Free standing, relief, and architectural sculpture from the archaic period to the Hellenistic age, representing changing aesthetic, social, and political aims. C-L: Art 238S. 3 units. *Younger*

**232S. Greek Painting.** From the Late Bronze Age to the fourth century B.C., with emphasis on archaic and classical Athenian vase painters. C-L: Art 237S. 3 units. *Stanley*

**258. The Hellenistic and Roman East.** The social and cultural history of the Greco-Roman world, concentrating on papyrological evidence. Prerequisites: knowledge of ancient Greek and Latin. 3 units. *Oates*

#### **For Graduates**

**301. Proseminar: Introduction to Classical Studies.** 3 units. *Rigsby*

**311. Archaeology Seminar I.** Selected topics. 3 units. *Staff*

**312. Archaeology Seminar II.** Selected topics. 3 units. *Staff*

**321. Seminar in Ancient History I.** Selected topics. 3 units. *Boatwright, Oates, or Rigsby*

**322. Seminar in Ancient History II.** Selected topics. 3 units. *Boatwright, Oates, or Rigsby*

**399. Directed Reading and Research.** Credit to be arranged. Variable credit. *Staff*

#### **Courses Currently Unscheduled**

**221. Archaic Greece**

**223. Alexander and the Hellenistic World**

**226. Late Antiquity**

**233S. Greek Architecture**

**234S. Roman Sculpture**

**235S. Roman Architecture**

**236S. Roman Painting**

**327. Seminar in Byzantine History**

Under the terms of a cooperative agreement, graduate students of Duke University may take any graduate course offered by the Department of Classics of the University of North Carolina. A list of these courses will be sent upon request.

## **Computer Science**

Professor Vitter, *Chair* (D315 Levine Science Research Center); Associate Professor of the Practice Ramm, *Associate Chair* (D310 Levine Science Research Center); Associate Professor Wagner, *Director of Graduate Studies* (D336 Levine Science Research Center); Professors Behringer, Biermann, Gelenbe, Loveland, Marinos, Palmer, Reif, Rose, Starmer, Trivedi, and Utku; Associate Professors Agarwal, Board, Ellis, Greenside, and Kadem; Assistant Professors Chase, Kao, Prisant, and Sun; Assistant Professors of the Practice Astrachan and Rodger; Professors Emeritus Gallie and Patrick; Assistant Research Professors Grove and Long; Adjunct Professors Coughran and Whitted; Adjunct Associate Professor Brglez; Adjunct Assistant Professors Levenson and Marshall

The Department of Computer Science offers programs leading to the M.S. and Ph.D. degrees. The department also actively cooperates with the Department of Computer Science of the University of North Carolina at Chapel Hill.

A student entering graduate work in computer science should have had three semesters of calculus and one semester of linear algebra, and should have a knowledge of data structures, and of assembler as well as higher-level computer programming

languages. Research interests of present faculty include mathematical foundations of computer science, artificial intelligence, analysis of algorithms, programming methodology, real-time computing, operating data base systems, computer systems design and analysis, parallel processing systems, scientific computation (including numerical analysis), and VLSI design.

Each student should consult the document *Graduate Degree Requirements of the Computer Science Department* for degree requirements not listed in this bulletin.

### **For Seniors and Graduates**

**206. Programming Languages.** Information binding, data structures and storage, control structures, recursion, execution environments, input/output; syntax and semantics of languages; study of PL/1, Fortran, Algol, APL, LISP, SNOBOL, and SIMULA; exercises in programming. Not open to students who have taken Computer Science 201. Prerequisite: Computer Science 200 or 208. 3 units. *Wagner*

**208. Programming Methodology.** Practical and theoretical topics including structured programming, specification and documentation of programs, debugging and testing strategies, choice and effective use of programming languages and systems, psychology of computer programming, proof of correctness of programs, analysis of algorithms, and properties of program schemata. Not open to students who have taken Computer Science 200. Prerequisite: Computer Science 100 or 103. 3 units. *Staff*

**210. Operating Systems.** Fundamental principles of operating system design applied to state-of-the-art computing environments (multiprocessors and distributed systems) including process management (coscheduling and load balancing), shared memory management (data migration and consistency), and distributed file systems. Advanced topics include transaction-based operating systems, reliable communication protocols, concurrency control and recovery mechanisms, computer security, and performance analysis. Not open to students who have taken Computer Science 231. 3 units. *Chase or Ellis*

**214. Computer Networks and Distributed Systems.** Basic systems support for process-to-process communications across a computer network. The TCP/IP protocol suite and the Berkeley sockets application programs interface. Development of network application programs based on the client-server model. Remote procedure call and implementation of remote procedure call. Not open to students who have taken Computer Science 255. Prerequisite: knowledge of the C programming language. 3 units. *Staff*

**216. Data Base Methodology.** Basic concepts and principles. Relational, hierarchical, and network approaches to data organization; data entry and query language support for data base systems; theories of data organization; security and privacy issues. Not open to students who have taken Computer Science 241. Prerequisites: Computer Science 104 and either 109 or 155 or equivalent. 3 units. *Staff*

**218. Compiler Construction.** Models and techniques used in the design and implementation of assemblers, interpreters, and compilers. Lexical analysis, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation and optimization techniques. Not open to students who have taken Computer Science 232 before fall 1994. 3 units. *Staff*

**220. Computer Systems Organization.** Hardware and software aspects. Processor, memory, device, and communication subsystems; case studies of hardware system organization, for example, parallel, associative, fault-tolerant; organization of software systems to exploit hardware systems organization; economic and reliability aspects of various hardware organizations. Not open to students who have taken Computer



Science 252 before fall 1994. Prerequisites: Computer Science 104 and 120 or 157. 3 units. *Wagner*

**222. Introduction to VLSI Systems.** A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Not open to students who have taken Computer Science 210 before fall 1994. Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 161 or equivalent. 3 units. *Staff*

**223. Application Specific VLSI Design.** Introductory VLSI design course. Modern design methods and technology for implementing application specific integrated circuits (ASICs). Semicustom design methodology, semicustom VLSI technologies such as gate arrays, standard cells and FPGAs; the use of ASIC Computer Aided Design (CAD) tools. Mapping algorithms into high performance silicon implementation. Prerequisite: course in logic design. 3 units. *Kedem*

**225. Fault-Tolerant and Testable Computer Systems.** Not open to students who have taken Computer Science 207. Prerequisite: Electrical Engineering 151 or equivalent. See C-L: Electrical Engineering 254. 3 units. *Marinos*

**226. Mathematical Methods for Systems Analysis I.** Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four semesters of college mathematics. C-L: Electrical Engineering 255. 3 units. *Trivedi*

**228. Communication, Computation, and Memory in Biological Systems.** Communication and memory in biological systems: voltage sensitive ion channels, hormone-receptor interactions, and initiation and control of RNA/DNA synthesis. Models of signaling and memory are developed and related to electronic signaling schemes. Not open to students who have taken Computer Science 276. Prerequisites: Computer Science 100 or 103, two semesters of college chemistry, and four semesters of college mathematics. 3 units. *Starmer*

**230. Design and Analysis of Algorithms.** Design and analysis of efficient algorithms. Algorithmic paradigms. Applications include sorting, searching, dynamic structures, graph algorithms, randomized algorithms. Computationally hard problems. NP completeness. Not open to students who have taken Computer Science 205. Prerequisite: Computer Science 100 or equivalent. 3 units. *Agarwal, Kao, or Reif*

**232. Mathematical Analysis of Algorithms.** Techniques for efficient implementation and precise analysis of computer algorithms. Combinatorial mathematics and elementary probability. Emphasis on obtaining exact closed-form expressions describing the worst-case or average-case time and space requirements for particular computer algorithms, whenever possible. Asymptotic methods of analysis for obtaining approximate expressions in situations where exact expressions are too difficult to obtain or to interpret. Not open to students who have taken Computer Science 202. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Vitter*

**234. Computational Geometry.** Models of computation and lower-bound techniques; storing and manipulating orthogonal objects; orthogonal and simplex range searching, convex hulls, planar point location, proximity problems, arrangements, linear programming and parametric search technique, probabilistic and incremental algorithms. Not open to students who have taken Computer Science 240 before fall 1994. Prerequisite: Computer Science 205 or 230 or equivalent. 3 units. *Agarwal or Reif*

**236. Parallel Algorithms.** Models of parallel computation including parallel random access machines, circuits, and networks; NC algorithms and P-completeness; graph algorithms, sorting algorithms, network routing, tree contraction, string matching, parsing algorithms; randomization and derandomization techniques. Not open to students who have taken Computer Science 230 before fall 1994. Prerequisite: Computer Science 205 or 230 or equivalent. 3 units. *Kao or Reif*

**240. Computational Complexity.** Turing machines, undecidability, recursive function theory, complexity measures, reduction and completeness, NP, NP-Completeness, co-NP, beyond NP, relativized complexity, circuit complexity, alternation, polynomial time hierarchy, parallel and randomized computation, algebraic methods in complexity theory, communication complexity. Not open to students who have taken Computer Science 225 before fall 1994. Prerequisite: Computer Science 140 or equivalent. 3 units. *Agarwal*

**242. Logic for Computer Science.** Aspects of logic with a focus on computational issues. Topics include propositional and predicate calculi and the theory underlying their automation, that is, the compactness theorems, the Herbrand-Skolem-Gödel theorem, unification, and resolution. Proof procedures and their search characteristics. The use of natural deduction and sequent calculi in describing logics, specifying programming language semantics and formalizing type systems. Structural properties, such as cut-elimination, in such systems. The logical systems underlying programming languages like Prolog and ML. Applications of logic in automated reasoning, program verification and synthesis. Not open to students who have taken CPS 218 before fall 1994. C-L: Philosophy 210. 3 units. *Loveland*

**250. Numerical Analysis.** Error analysis, interpolation and spline approximation, numerical differentiation and integration, solutions of linear systems, nonlinear equations, and ordinary differential equations. Not open to students who have taken Computer Science 221. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. C-L: Mathematics 221 and Statistics 273. 3 units. *Greenside or Rose*

**252. Numerical Differential Equations.** Numerical methods for solving ordinary and partial differential equations emphasizing nonlinear differential equations. Methods for solving ordinary differential equations that generalize to solve partial differential equations: finite difference, spectral, and finite element methods. Solution of hyperbolic, parabolic, and elliptical partial differential equations arising in scientific problems. Not open to students who have taken Computer Science 222 before fall 1994. Prerequisite: Computer Science 221 or 250. C-L: Mathematics 222. 3 units. *Greenside or Rose*

**254. Numerical Linear Algebra.** Solution of large, sparse linear systems of equations. Storage schemes, graph theory for sparse matrices, different orderings to minimize fill, block factorizations, iterative methods, analysis of different splittings, conjugate gradient methods. Eigenvalue problems, QR factorization, Lanczos method, power method and inverse iteration, Rayleigh quotient. Not open to students who have taken Computer Science 223 before fall 1994. Prerequisite: Computer Science 221 or 250 or equivalent. C-L: Mathematics 223. 3 units. *Rose or Sun*

**260. Introduction to Computational Science.** Introduction for students and faculty to computing resources that facilitate research involving scientific computing: contemporary computers, programming languages, numerical software packages, visualization tools, and some basic issues and methods for high performance algorithm design. Prerequisite: programming experience in Fortran or C, calculus, numerical linear algebra or equivalent. 3 units. *Greenside, Rose, or Sun*



**264. Nonlinear Dynamics.** Introduction to the mathematical theory of nonlinear dynamics, and how this theory compares with physical experiments, with applications to biology (Turing states and morphogenesis), computer science (randomness and computability), mathematics (chaos and strange attractors), and physics (pattern formation and transition to turbulence). Not open to students who have taken Computer Science 213. Prerequisites: Computer Science 8 or 53, Mathematics 111, and Physics 51L, 52L. C-L: Physics 213. 3 units. *Behringer or Greenside*

**270. Artificial Intelligence.** Heuristic versus algorithmic methods; programming of games such as chess; theorem proving and its relation to correctness of programs; readings in simulation of cognitive processes, problem solving, semantic memory, analogy, adaptive learning. Not open to students who have taken Computer Science 215. Prerequisite: Computer Science 100 or 103 or consent of instructor. 3 units. *Biermann or Loveland*

**274S. Computational Linguistics Seminar.** Readings and research seminar on topics related to the processing of English or other natural languages: syntax, semantics, pragmatics, discourse, and others. Not open to students who have taken Computer Science 216S. Prerequisite: Computer Science 215 or 270 or consent of instructor. 3 units. *Biermann*

**291. Reading and Research in Systems.** 3 units. *Staff*

**292. Reading and Research in Algorithms and Complexity.** 3 units. *Staff*

**293. Reading and Research in Scientific Computing.** 3 units. *Staff*

**294. Reading and Research in Artificial Intelligence.** 3 units. *Staff*

**296. Advanced Topics in Computer Science.** Not open to students who have taken Computer Science 265. 3 units. *Staff*

## **For Graduates**

**300. Computer Science Research Seminar.** The course is designed to orient first-year graduate students and to provide an in-depth look at the research projects going on in the department. The course also emphasizes the necessary skills for research investigation and presentation in computer science. In particular, instruction is given in how to formulate research problems or projects, identify goals, and present results. (Concentration on the problem-solving aspect of research is the focus of the research project or thesis during the following semester.) Students will make and critique technical presentations, both oral and written. Not open to students who have taken Computer Science 303. 3 units. *Vitter*

**310. Topics in Operating Systems.** Not open to students who have taken Computer Science 332. 3 units. *Staff*

**320. Advanced Topics in Digital Systems.** Not open to students who have taken Computer Science 308. Prerequisite: Electrical Engineering 252 or equivalent. See C-L: Electrical Engineering 352. 3 units. *Staff*

**322. Advanced VLSI Design.** Theory of advanced VLSI design. Specifications development, methodology, issues, circuit-level trade-offs. Full custom design, standard cell design, gate array design, silicon compilation. Semiconductor technologies and logic families for semi-custom design. Clocking schemes and distribution, race conditions. Design of a variety of circuits (adders, I/O drivers, RAM, FIFO, etc.) Testing of all phases in the life cycle of an integrated circuit. Top-down design and bottom-up implementation. Student projects. Not open to students who have taken Computer Science 310



before Fall 1994. Prerequisite: Electrical Engineering 261 or equivalent. C-L: Electrical Engineering 361. 3 units. *Kedem*

**327. Seminar in Computer Systems Analysis.** Topics in computer systems analysis, especially for fault-tolerant systems, including reliability, availability and performance analysis, comparative analysis of architectures, performability, analytic and numerical solution techniques, stochastic Petri nets, simulation. Not open to students who have taken Computer Science 381. 1 to 3 units. Variable credit. *Trivedi*

**331. Operating Systems Theory.** Advanced study of theoretical aspects of operating systems emphasizing models and control of concurrent processes, processor scheduling, and memory management. Prerequisites: Computer Science 226 and 231. 3 units. *Ellis or Wagner*

**340. Theory of Computation.** Not open to students who have taken Computer Science 325. 3 units. *Staff*

**350. Topics in Numerical Mathematics.** Advanced topics in numerical mathematics to be selected from areas of current research. Not open to students who have taken Computer Science 321. Prerequisites: Computer Science 250 and 252. 3 units. *Greenside, Rose, or Sun*

**364. Advanced Topics in Nonlinear and Complex Systems.** Survey of current research topics that may include: advanced signal analysis (wavelets, Karhunen-Loeve decomposition, multifractals), bifurcation theory (amplitude and phase equations, symmetry breaking), spatio-temporal chaos, granular flows, broken ergodicity, complexity theory of dynamical systems, and adaptive systems (genetic algorithms, neural networks, artificial life). Emphasis on quantitative comparisons between theory, simulations, and experiments. Not open to students who have taken Computer Science 313. Prerequisites: Computer Science 264 or Physics 213; recommended: Physics 230, 231, and 303 or equivalents. C-L: Physics 313. 3 units. *Behringer, Greenside, or Palmer*

**370. Seminar in Artificial Intelligence.** Topics in artificial intelligence, such as natural language understanding, learning, theorem proving and problem solving, search methodologies. Topics will vary from semester to semester. Includes research literature reading with student presentation. Not open to students who have taken Computer Science 382. 1 to 3 units. Variable credit. *Staff*

**376. Advanced Topics in Artificial Intelligence.** Course content will vary from year to year and will include a detailed study of one or more of the following: mechanical theorem proving, natural language processing, automatic program synthesis, machine learning and inference, representations of knowledge, languages for artificial intelligence research, artificial sensorimotor systems, and others. Not open to students who have taken Computer Science 315. Prerequisite: Computer Science 270. 3 units. *Biermann or Loveland*

**395. Research.** Instruction in methods used in the investigation of original problems. Individual work and conferences. 1 to 6 units. Variable credit. *All members of the graduate staff*

**399. Special Readings.** Variable credit. *Staff*

## **COURSES CURRENTLY UNSCHEDULED**

**256. Functional Analysis for Scientific Computing**

**326. Systems Modeling**

**337. VLSI Algorithmics**

## SUPPLEMENTARY COURSES OFFERED AT UNC-CH

**Comp 145. Software Engineering Laboratory**

**Comp 171. Natural Language Processing**

**Comp 230. File Management Systems**

**Comp 236. Computer Graphics**

**Comp 238. Raster Graphics**

**Comp 254. Picture Processing and Pattern Recognition**

**Comp 265. Architecture of Computers**

## Cultural Anthropology

Associate Professor Quinn, *Chair*; Professor Silverblatt, *Director of Graduate Studies*; Professors Apte, Mudimbe (literature), O'Barr, and Reddy (history); Associate Professor Silverblatt; Assistant Professors Allison, Ewing, Litzinger, Starn, Strauss, and Tetel (English); Professors Emeriti Friedl and La Barre; Assistant Research Professor Chandler (English); Assistant Professor of the Practice Luttrell; Adjunct Professor Conley

The department offers graduate work leading to the Ph.D. degree in cultural anthropology. It also participates in a program with the law school leading to a joint J.D./M.A. degree. Students' active role in development of their own research goals and design of their own plan of study, as well as their pursuit of relevant cross-disciplinary background, within and outside the department, is expected. Courses in anthropological theory and research methodology, as well as spoken and/or written competence in at least one foreign language, at the level appropriate to the planned research program, are required. The core courses include two year-long sequences: Theories in Cultural Anthropology (330S, 331S), required of first-year graduate students, and Research Seminar in Cultural Anthropology (332S, 333S), required in the fourth and fifth semesters. Students must also take an approved methods course. Summer field research is strongly encouraged. The *Guidelines for Graduate Students in the Doctoral Program in Cultural Anthropology* and the *Guidelines for Graduate Students in the J.D./M.A. Program* fully describe these and additional requirements and the detailed steps in the student's graduate career.

### For Seniors and Graduates

**206S. Anthropological Controversies.** Central issues in anthropological theory and method examined through some of the discipline's major controversies: Mead vs. Freeman on Samoan sexuality; Weiner vs. Malinowski on the kula; Sahlins vs. Obeyesekere on Cook and Hawaii; Harris vs. critics on the sacred cow; Harris vs. Sahlins on Aztec cannibalism; and Leach vs. Levi-Strauss on generalized exchange. 3 units. *Piot*

**207S. Anthropology and History.** Recent scholarship that combines anthropology and history, including culture history, ethnohistory, the study of mentalité, structural history, and cultural biography. The value of the concept of culture to history and the concepts of duration and event for anthropology. Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. C-L: History 210S. 3 units. *Reddy*

**208S. Postcolonial Anthropology.** Interdisciplinary approach to the review and critique of postcolonial ethnography and historiography. How postcolonial scholarship questions historical modes of cultural ordering and representation and envisions new modes of reading and writing in relation to global structures of domination. 3 units. *Ewing, Litzinger, Silverblatt, or Starn*



**210S. Ideology and the Image in Ethnographic Film.** Overview of the history of ethnographic film. Emphasis placed on knowledge of the film canon, recent innovations in ethnographic documentation, and critical skills for understanding the political and epistemological quandaries of representation. Topics such as narrativity, authorship, spectatorship, and psychoanalytic and feminist film criticism explored in relation to ethnographic film theory and practice. 3 units. *Litzinger*

**211S. Ethnography of Communication.** History of the mutual influence of linguistics and anthropology leading to the development of ethnography of speaking, ethno-science, structuralism, and sociolinguistics. Topics vary each semester. Prerequisite: Cultural Anthropology 107 or 119. 3 units. *Apte or O'Barr*

**214. Postmodernism and the Problem of Representation.** How postmodernism has shaped recent anthropological discourse. Analysis of the premises of postmodernist epistemology and identification of key issues such as truth, authority, and power that are raised by postmodernist critiques of ethnographic representation. Examination of both traditional and experimental ethnographies. 3 units. *Ewing*

**215S. The Anthropology of Gender: Theoretical Issues.** Topics to be selected each semester from: feminist theory and anthropology; Marxism and feminism; gender, ideology, and culture; gender and colonialism; gender and the third world; and others. C-L: Women's Studies. 3 units. *Allison, Luttrell, Quinn, Silverblatt, or Starn*

**216S. Gender, Race, and Class.** Gender, race, and class as theoretical constructs and lived experiences. Analytical frameworks include social history, discourse analysis, critical theory, cultural studies, and feminist theories. Consent of instructor required. 3 units. *Luttrell*

**217. Culture Versus Nature? History and Ecology in Anthropology.** Historical and evolutionary approaches to the ways that human cultures and natural environments have modified and constrained one another; focus on technologies rather than on national or international environmental policy. Consent of instructor required. 3 units. *Staff*

**220S. Theoretical Bases of Social Interpretation.** See C-L: History 290S. 3 units. *Reddy*

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: History 234S and Sociology 234S. 3 units. *Staff*

**250S. Culture and Discourse.** Theoretical approach to culture and methods for the investigation of culture through analysis of discourse, especially interview texts. Application of this approach and these methods to the study of a domain of American culture. 3 units. *Apte, Ewing, O'Barr, Quinn, or Strauss*

**251. Cognitive Anthropology.** A cognitively-based theory of culture, its history, justification, substantiation through discourse analysis, application to everyday understanding, feeling and motivation, and implications for the acquisition of culture, cross-cultural variation and cultural universals in human thought. Not open to students who have taken Cultural Anthropology 151. 3 units. *Quinn or Strauss*

**258S. Theories of Symbolism.** Influential interpretations of symbols, what they do, and how they do it. The relationship of language to symbolism and symbolism to power. Prerequisites: junior/senior status and at least two courses in cultural anthropology, or graduate standing. 3 units. *Ewing*

**261. Religion: Tradition and Cultural Innovation.** Analysis of anthropological approaches to religion, with an emphasis on how these theories account for conflict and



change as they are manifested in religious symbols and ritual action. 3 units. *Ewing or Piot*

**262S. Anthropology and Folklore.** Origins, conceptualizations and theoretical orientations, methodology, and subject matter of the discipline of folklore and exploration of its similarities with and differences from sociocultural anthropology. 3 units. *Apte*

**265S. Anthropological Approaches to Life History.** Form and function of life history and its linkages to sociocultural systems; methodology for collecting life history in ethnographic fieldwork; textual, social-structural, and interpretive analyses of life history. 3 units. *Apte*

**280S, 281S. Seminar in Selected Topics.** Special topics in methodology, theory, or area. Consent of instructor required. 3 units each. *Staff*

**282S. Canada.** See C-L: History 282S; also C-L: Economics 282S, Political Science 282S, and Sociology 282S. 3 units. *Staff*

**284S. Feminist Theory and the Social Sciences.** See C-L: Women's Studies 284S; also C-L: History 284S, Political Science 264S, Psychology: Social and Health Sciences 284S, and Sociology 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spenner*

**290. Research Methods in Japanese.** See C-L: Japanese 291; also C-L: History 292. 3 units. *Staff*

### For Graduates

**330S, 331S. Theories in Cultural Anthropology.** A two-semester seminar in which the historical development of the field and its modern currents and debates are examined and discussed. Particular topics to be chosen by the instructors. 3 units each. *Staff*

**332S, 333S. Research Seminar in Cultural Anthropology.** Yearlong projects, from research design and formal proposal through location of research site, data collection, data analysis and theory development to write-up. Approaches, methods, and lessons appropriate to these projects. 3 units each. *Staff*

**393. Individual Research in Cultural Anthropology.** Supervision and guidance of A.M. thesis preparation, Ph.D. dissertation preparation, or other intensive research on a selected problem. 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

**201S. Marxism and Anthropology**

**219. Language and Social Theory**

**239. Culture and Ideology**

**272S. Marxism and Feminism**

## Economics

Professor de Marchi, *Chair* (215A Social Sciences); Professor Kimbrough, *Director of Graduate Studies* (209 Social Sciences); Professors Clotfelter, Cook, Goodwin, Grabowski, Graham, Havrilesky, Kelley, Ladd, McElroy, Moulin, Sloan, Smith, Tauchen, Tower, Trembl, Vernon, Viscusi, Weintraub, and Yohe; Associate Professors Conrad, Kramer, Litzel, and Marshall; Assistant Professors An, Bansal, Gentry, Hamilton, Peretto, and Yang; Professors Emeriti Blackburn, Bronfenbrenner, Davies, Kreps, and Wallace; Research Professor Burmeister; Adjunct Professor Gallant; Adjunct Associate Professor Zarkin; Visiting Assistant Professor Ramachandran

The Department of Economics offers graduate work leading to the A.M. and Ph.D. degrees. Among the undergraduate courses of distinct advantage to the graduate student in economics are statistics, economic theory, and basic courses in mathematics and social sciences other than economics. Advanced work in mathematics or statistics is very useful.

Requirements for the Ph.D. degree in economics include courses in economic theory and econometrics in the first year. By the beginning of the third year, the student must have passed a core examination in economic analysis. In addition, a student must obtain certification in three fields, one of which may be in an outside minor. The student may select from advanced economic theory, health economics, history of political economy, economic development, economic history, international economics, money and banking, labor economics, public finance, industrial organization, econometrics, Soviet economics, and certain fields outside the economics department (e.g., finance, resource and environmental economics, statistics, or demography). Course work for the Ph.D. degree should be completed in five or six semesters of residence.

### **For Seniors and Graduates**

**205S. Advanced Monetary Theory and Policy.** The theory of monetary policy from Keynesian, neoclassical and classical perspectives. Public choice and political economy approaches to monetary policy. The term structure interest rates. Portfolio theory. The theory of the financial services firm. Theories of financial regulatory policy. Prerequisites: Economics 153 and Statistics 10D. 3 units. *Havrilesky*

**206S. Regulation and Industrial Economics.** Analysis of industrial competition and performance in industries such as automobiles, telephones, cable TV, airlines, pharmaceuticals, tobacco, and health care services. Analysis of the efficiency of regulation and other public policy programs. Prerequisites: Economics 149 and statistics. 3 units. *Grabowski*

**207. Models of Conflict and Cooperation.** Cooperative and noncooperative game theory with applications to trading, imperfect competition, cost allocation, and voting. Prerequisites: Economics 149 and Mathematics 31. 3 units. *Moulin*

**208S. Economics of the Family.** Economic functions of families including home production gains from marriage, the demand for children, marriage and divorce, child support and alimony, labor supplies of women and men, the distribution of resources within families ("rotten kid theorems" and cooperative and noncooperative games). Applications to marriage and divorce law, day care, U.S. welfare policy, mortality, and farm efficiency in developing nations. Prerequisites: Economics 149 and Statistics. 3 units. *McElroy*

**215S. Applied Cost Benefit Analysis.** The principles of economic cost benefit analysis applicable to circumstances in which market valuations do not provide adequate measures of social desirability. Socially relevant prices for labor, capital, energy, materials, foreign exchange, and valuation of public goods. Development of analysis for individual projects, extended to cover economic policies. Prerequisite: Economics 149. 3 units. *Staff*

**216S. Economics of Education.** Topics include investment in human capital, return to and demand for education, the production function for schooling, public expenditures on schools, effectiveness of private and public schools, the distribution of public educational expenditures, public financing of higher education, inflation in college costs, and labor markets for teachers and professors. Emphasis on students' research projects. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Public Policy Studies 216S. 3 units. *Clotfelter*



**218. Macroeconomic Policy.** Does not count for undergraduate economics major requirements. See C-L: Public Policy Studies 218. 3 units. *Leitzel or McElroy*

**219S. Economic Problems of Underdeveloped Areas.** Analysis of underdeveloped countries with attention to national and international programs designed to accelerate development. Prerequisite: Economics 149 or consent of instructor. 3 units. *Kelley or Wallace*

**220S. Computer Modeling for Policy Analysis.** Introduction to the use of computer techniques in economic policy evaluation; policy applications to international economics, public finance and development economics; computer analysis of linearized and nonlinear models. Students required to complete a major modeling project. Prerequisites: Economics 149 and Economics 154. 3 units. *Tower*

**225S. Games and Information.** Noncooperative game theory with emphasis upon incomplete/imperfect information and incentive contracting. Applications to insurance (deductibles, coinsurance), labor (piece rates, sharecropping, profit sharing), real estate (commission sales), and law (contingent contracts). Prerequisites: Economics 149 and statistics. 3 units. *Graham*

**234. Japanese Economy and Its History.** Japanese economic development since the end of isolation, in the mid-nineteenth century. Not open to students who have had Economics 134. Prerequisite: one course in economics or Far Eastern history. 3 units. *Bronfenbrenner*

**239. Introduction to Econometrics.** Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. (Same as Economics 139 but requires additional term paper; not open to students who have taken Economics 139.) Prerequisites: Economics 2D or 2S or 52D and Mathematics 32 or equivalent and Statistics 10D or equivalent. 3 units. *McElroy, Tauchen, or Wallace*

**240. Comparative Economic Systems.** Analysis and comparison of basic economic systems; market versus centrally planned economies; decision making, information, property rights (income and control), and incentives. Western industrialized market economies compared with Soviet-type command economies. Analysis of change, reforms, and of economic problems of systems transformation. Not open to students who have taken Economics 140. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. 3 units. *Tremi*

**242S. Chinese Economy in Transition.** Evolution of the Chinese economy since 1949. Exposition of alternative economic systems, the commune, incentive problems and state enterprises. Analysis of recent reforms and their effects on economic efficiency: agricultural growth, changes in ownership structures, financial markets, reforms and inflation, privatization, gradualism and shock treatment. Through a research project students develop expertise in one aspect of the Chinese economy. (Same as Economics 142S but requires additional paper; not open to students who have taken Economics 142 or 142S.) Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. C-L: Public Policy Studies 242S. 3 units. *Yang*

**244. Education, Development, and Growth.** The basic elements of human capital theory and its application to economic growth and development. Topics include human capital investment, life-cycle earnings, impact of education on farm efficiency, migration, national income accounting, and models of endogenous growth. Data from the United States and other countries are used to test theoretical implications. (Same as Economics 144 but requires additional work; not open to students who have taken Economics 144.) Prerequisites: Economics 149, Economics 154, and Statistics 110B. 3 units. *Yang*



**249. Microeconomics.** Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. (Similar to Economics 149 but at a more advanced level; not open to students who have taken Economics 149.) 3 units. *Graham, Trembl, or Vernon*

**250S. Modern Economic Thought.** Selective survey of themes in economic thinking since 1936, including the role of empirical work and of formalization. Prerequisites: Economics 149, 154, and Statistics 10D or consent of instructor. 3 units. *De Marchi or Weintraub*

**251S. Regulation of Vice and Substance Abuse.** Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Public Policy Studies 251S. 3 units. *Cook*

**253. Econometric Methods.** Econometric and statistical methods for applied economic research. Topics include multivariate regression, hypothesis testing, mean square error criteria, and related subjects. Prerequisites: Economics 139 or 239, Economics 149, or equivalents. Calculus and matrix algebra recommended. 3 units. *Wallace*

**254. Macroeconomics.** Concepts and measurement of national income and expenditures, employment, interest rates, and price levels; the theoretical determination of these aggregates; applications of macroeconomic theory to business cycles and economic growth. (Similar to Economics 154 but at a more advanced level; not open to students who have taken Economics 154.) 3 units. *De Marchi, Havrilesky, Kimbrough, Tower, or Yohe*

**258. Financial Markets and Investments.** The tools learned in microeconomics, macroeconomics, basic mathematics, and statistics applied to problems in financial economics. A blend of pure economic theory, an investigation of financial data, and practical applications using personal computers. Not open to students who have had Economics 158. Prerequisites: Economics 149, Economics 154, and a statistics course—preferably Statistics 110 or 210. 3 units. *Burmeister*

**259S. State and Local Public Finance.** Prerequisite: Public Policy Studies 217 or equivalent. See C-L: Public Policy Studies 259S. 3 units. *Ladd*

**260. Economic Policy Analysis of Nonrenewable Resources.** Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. See C-L: Public Policy Studies 260. 3 units. *Conrad*

**261. Evaluation of Public Expenditures.** Not open to students who have taken Economics 285. See C-L: Public Policy Studies 261; also C-L: Environment 272. 3 units. *Conrad*

**262S. Seminar in Applied Project Evaluation.** Prerequisite: Economics 285 or Public Policy Studies 261. See C-L: Public Policy Studies 262S. 3 units. *Conrad*

**263. Environmental Economics: Theory and Application.** Role of materials and energy balances in modeling production and consumption; externalities and Pigouvian taxes; property rights and open access resources; role of market structure; design of policy instruments and actual practice; contrasts between domestic and international environmental policies. Prerequisite: Economics 149. 3 units. *Smith*

**265. International Trade and Finance.** Fundamental principles of international economic relations. The economic basis for international specialization and trade, the economic gains from international trade and investment, the balance of payments, international finance, and the international monetary system. Prerequisites: Economics 149 and 154. 3 units. *Kimbrough or Tower*

**266S. Current Issues in International Economics.** Emphasis on individual research projects. Prerequisite: Economics 165, 265, or consent of instructor. 3 units. *Kimbrough or Tower*

**269. Microeconomic Analysis.** The basic tools for using microeconomic analysis to address practical economic problems. Topics include consumption, production, externalities, partial equilibrium, and general equilibrium. Applications drawn from labor markets, public goods, cost/benefit analysis, and optimal taxation. The level of the course is between intermediate microeconomics (Economics 149/249) and the core Ph.D. microeconomics sequence (Economics 301/302). 3 units. *Yang*

**270L. Resource and Environmental Economics.** Includes laboratory. Prerequisite: introductory course in microeconomics. See C-L: Environment 270L; also C-L: Public Policy Studies 272L. 4 units. *Kramer*

**271S. Behavioral and Experimental Economics.** The relationship between actual behavior and economic models. Topics include individual decision-making behavior, game theory, and the role of market institutions. The interaction of economic and psychological theory. Students will have the opportunity to participate in, and conduct, economic experiments. (Same as Economics 171 but requires an additional paper; not open to students who have taken Economics 171.) Prerequisite: Economics 149 or consent of instructor. 3 units. *Staff*

**272. Economic Analysis of Resource and Environmental Policies.** Prerequisite: Environment 270L or equivalent; Economics 149 recommended. See C-L: Environment 271. 3 units. *Staff*

**273. Economics of Organization and Management.** Coordination and motivation issues within a corporation along with the internal design and dynamics of organizations. Topics include the structure of employment contracts, performance incentives, and the pricing of financial assets. (Same as Economics 173 but requires additional paper; not open to students who have taken Economics 173.) Prerequisite: Economics 149. 3 units. *Marshall*

**280S. Fundamentals of Political Economy.** See C-L: Political Science 270S. 3 units. *Aldrich, Bianco, or Niou*

**282S. Canada.** See C-L: History 282S; also C-L: Cultural Anthropology 282S, Political Science 282S, and Sociology 282S. 3 units. *Staff*

**286S. Economic Policy-Making in Developing Countries.** See C-L: Public Policy Studies 286S. 3 units. *Conrad or Ramachandran*

**287. Public Finance.** Economic aspects of the allocative and distributive role of government in the economy, the incidence and efficiency of taxation, the effects of taxation on behavior, and analysis of major government spending programs. Not open to students who have had Economics 187. (Taught concurrently with Economics 187 but requires additional graduate-level work.) Prerequisite: Economics 149. 3 units. *Gentry*

**288S. Current Issues in United States Federal Tax Policy.** Evaluation of the equity and efficiency of United States tax policy. Topics include: (1) personal consumption versus income taxation and (2) restructuring the taxation of corporate income. Emphasis on the effects of taxes on savings, investment, and the international economy. Prerequisite: Economics 149 or consent of instructor. C-L: Public Policy Studies 288S. 3 units. *Gentry*

**292S. Issues in the Transition of Economic Systems.** 3 units. *Leitzel*

**293S. Soviet Economic History.** From 1917 through the present. Foundations of the command economy—rejection of markets, central planning, industrialization, collectiv-



ization of agriculture; economic reforms and search for economic efficiency. Gorbachev's perestroika and the dissolution of the Soviet Union. 3 units. *Trembl*

**294S. Soviet Economic System.** Economic planning and administration in the Soviet Union. Theoretical and applied problems of resource allocation, economic development, and optimal micro decision making in a nonmarket economy. Gorbachev's perestroika, search for a new model, and the collapse of the Soviet system. 3 units. *Trembl*

#### **For Graduates**

**232. Microeconomics: Policy Applications.** Graduate status only. Prerequisites: Economics 149 or Public Policy Studies 110 or 217 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. See C-L: Public Policy Studies 232. 3 units. *Conrad or Ladd*

**301. Microeconomic Analysis I.** Review of contemporary theory relating to consumer choice, production, the firm, and income distribution in competitive and imperfectly competitive markets. Restricted to Ph.D. students in economics except with consent of instructor and director of graduate studies. 3 units. *Marshall*

**302. Microeconomic Analysis II.** A continuation of Economics 301 with emphasis on analyses of consumer behavior, general equilibrium, welfare economics, and capital theory. Prerequisite: Economics 301. 3 units. *Graham*

**303. Microeconomic Analysis III.** A discussion of the formal models of economic justice with the tools of cooperative games and social choice. Topics include cost-sharing formulas, fair division, natural monopolies, public goods, collective preferences and utilities, and implementation theory. Prerequisites: Economics 301 and 302. 3 units. *Moulin*

**304. Advanced Macroeconomics.** Advanced topics in macroeconomics with some emphasis on computation and econometric analysis. Topics include real business cycle theory, endogenous growth theory, monetary theory, optimal monetary and fiscal policy and time consistency. 3 units. *Kimbrough or Peretto*

**305. Monetary Theory and Policy.** Same topics as Economics 205S but with additional graduate level work. Prerequisite: Economics 304. 3 units. *Haorilesky*

**309. Trade and Development Theory.** Theory of international trade and trade policy as it affects the structure and growth of individual economies, with emphasis on developing countries. Comparative advantage, factor proportions explanation of trade, infant industry and other arguments for protection, interactions of exchange rate and trade policy, and special issues relating to primary commodities are examined. 3 units. *Staff*

**311, 312. History of Political Economy.** A detailed review of the development of economic theory, the tools of economic analysis, and economics as a science, together with an analysis of the circumstances affecting this development. 3 units each. *De Marchi, Goodwin, or Weintraub*

**313, 314. Seminar in Economic Theory.** Prerequisite: Economics 301 or equivalent. 3 units each. *Weintraub*

**315. Noncooperative Game Theory.** A self-contained presentation of the main noncooperative concepts: dominant strategies, Nash equilibrium, subgame perfect equilibrium. Introduction to mixed and correlated strategies and the Bayesian equilibrium for games of incomplete information. Examples include oligopolistic competition, auctions, bargaining, and voting. C-L: Political Science 315 and Statistics 386. 3 units. *Moulin*



**316. Seminar in Economics of Soviet-Type Socialism.** Selected topics in analysis of theoretical and institutional framework of Soviet economic system, such as markets versus plan, optimizing techniques in planning, price determination, balanced economic development, and ideology and economic policy. 3 units. *Trembl*

**317. Development Economics I.** Historical, empirical, and theoretical topics in development economics. 3 units. *Kelley*

**318. Quantitative Development Economics.** Selected topics in development economics with emphasis on empirical techniques. Topics include economic growth, income distribution, labor markets, human capital fertility, health, and their relationship with structural adjustment. 3 units. *Staff*

**319. Seminar in the Theory and the Problems of Economic Growth and Change (Development Economics II).** Links between aid, financial markets, and real investment in an open economy stressing tariff protection and capital controls (internal and external). Economic policy-making using market solutions and/or planning models (input-output, linear programming, and computable general equilibrium). 3 units. *Staff*

**320. Macroeconomic Analysis I.** Intertemporal models of consumption and labor supply; implications of these models for the behavior of macroeconomic aggregates, fiscal policy, and monetary policy; money demand and inflation; economic growth. Restricted to Ph.D. students in economics except with consent of instructor and director of graduate studies. 3 units. *Kimbrough*

**322. Macroeconomic Analysis II.** Further analysis of topics treated in Economics 320. Optimal economic growth; business cycles. Issues in economic policy. Prerequisite: Economics 320. 3 units. *Kimbrough or Peretto*

**326. Stochastic Macroeconomics.** Advanced topics in macroeconomics with an emphasis on empirical macroeconomics and the interrelationship between economic theory and empirical work in macroeconomics. Topics include the interpretation of macroeconomic time series, formulating and testing models of asset pricing and market efficiency, solution and estimation of rational expectations models, vector autoregression models, and policy evaluation with empirical macroeconomic models. 3 units. *Bansal or Tauchen*

**329. Public Economics I.** Analysis of normative and positive models of the incidence and efficiency of taxation, and the effects of taxation on individual and firm behavior. 3 units. *Gentry*

**330. Public Economics II.** Public expenditure analysis including the analysis of externalities, benefit assessment, and risk and uncertainty. 3 units. *Viscusi*

**341. Quantitative Methods.** Various topics in linear algebra, advanced calculus, real analysis, statistics, econometrics, and computer programming, as relevant for Ph.D. level work in economics. Restricted to Ph.D. students in economics except with consent of instructor and director of graduate studies. Prerequisites: Economics 149 and 154; Mathematics 103, 104, or equivalent. 3 units. *Tauchen*

**344. Econometrics I.** Economic theory and statistics applied to analysis of economic phenomena. Matrix algebra and calculus used to develop methods for multiple regression and statistical inference. Prerequisite: Economics 241, 249, or equivalents. 3 units. *Marshall, McElroy, Tauchen, or Wallace*

**345. Applied Econometrics.** Applications of current econometric methodology to empirical problems with an emphasis on applied microeconomics. Topics include limited dependent variable, longitudinal and panel data analysis, and duration models. Prerequisites: Economics 341 and 344. 3 units. *An*

**347. Econometrics II.** Asymptotic theory for finite dimensional parametric models. Topics include nonlinear maximum likelihood, nonlinear regression, extremum estimators, aspects of computation, hypothesis testing, and models with limited dependent variables. Prerequisite: Economics 344. 3 units. *An or Tauchen*

**348. Econometrics III.** Advanced topics in econometrics including asymptotic theory, nonparametrics, and specification testing. Prerequisite: Economics 347. 3 units. *An, Gallant, and Tauchen*

**355. Seminar in Labor Economics.** 3 units. *Baumgardner or McElroy*

**356. Graduate Health Economics I.** Survey course designed for students considering Ph.D. research in health economics. Topics will include demand for health insurance, moral hazard, health as an investment, technological change, the principal-agent problem, occupational entry, and the supply of physician services. Prerequisites: Economics 243 and 301. 3 units. *Sloan*

**357. Seminar in Health Economics.** Conceptual and empirical analysis of demand for health, medical services, and insurance; decisions by physicians and hospitals about price, quantity, and quality of services; technological change; and structure and performance of the pharmaceutical industry. Prerequisites: Economics 243 and 301. 3 units. *Sloan*

**358. Seminar in Labor Market and Related Analysis.** A survey of several topics in modern labor economics including human capital, signaling, static and dynamic labor supply, household production, labor contracts, search, the theory of equalizing differences, and discrimination. 3 units. *Yang*

**359. Economic Analysis of Legal Issues.** An exploration of diverse topics in law and economics such as property rights and externalities, tort law and optimal accident prevention, bargaining and game theory, the economics of contracts, and theories of economic justice. 3 units. *Culp*

**363. Economics of Natural Resource Damage Assessment.** Topics vary each semester offered. 3 units. *Smith*

**365. Seminar in International Trade Theory and Policy.** 3 units. *Tower*

**366. Seminar in International Monetary Theory.** 3 units. *Kimbrough*

**372. Advanced Natural Resource Economics.** Methods for evaluating conservation, development, and restoration of renewable and exhaustible environmental resources. Introduction to the role of public goods and externalities in designing policies to sustain resource productivity and maintain environmental quality (developed in more detail in 373). Topics include renewable resources, exhaustible resources, intergenerational equity, property rights, and optimal control. Consent of instructor required. C-L: Environment 372. 3 units. *Staff*

**373. Advanced Environmental Economics.** Examination of the economic measurement of environmental benefits and damages. Consideration of economic concepts for the design of environmental policies. Topics include externality theory, public goods, contingent valuation, and hedonic models. Consent of instructor required. C-L: Environment 373. 3 units. *Kramer*

**380. Graduate Economics Workshops.** May be taken for multiple credit. Sections: .01 Industrial Organization and Regulation; .02 International Economics; .03 Labor Economics; .04 Macroeconomics; .05 Public Finance; .06 Economic Thought; .07 Corporate Economics; .08 Econometrics; .09 Economic Theory. 3 units each. Variable credit. *Staff*



**388. Industrial Organization.** Analysis of models of markets, especially oligopoly. Game theoretic models of entry deterrence and predation. Product selection and advertising and other selected topics. 3 units. *Grabowski, Marshall, or Vernon*

**389. Seminar in Industrial and Governmental Problems.** Criteria for evaluating industrial performance. Antitrust, policy toward innovation, natural monopoly regulation, and regulation of selected industries. 3 units. *Grabowski, Marshall, or Vernon*

**390. Economics of Auctions, Procurements, and Bargaining.** Study of allocation mechanisms where offers are considered simultaneously and sequentially. Special emphasis on the distinction between allocation mechanisms from the viewpoint of sellers and buyers. 3 units. *Marshall*

**397, 398. Directed Research.** 3 units each. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**207S. Models of Conflict and Cooperation**

**231S. Economic Development in Latin America**

**235. The Economics of Crime**

**248. Advanced Theory and Methods in Econometrics**

**307. Quantitative Analysis I**

**308. Quantitative Analysis II**

**321. Theory of Quantitative Economic Policy**

**323. Income Distribution Theory**

**324, 325. Economics of the Law**

**401. Seminar on the British Commonwealth**

**402. Interdisciplinary Seminar in the History of the Social Sciences**

#### **RELATED COURSES IN OTHER DEPARTMENTS**

Courses in related fields may be selected from anthropology, computer science, environmental studies, history, mathematics, philosophy, political science, public policy sciences, sociology, and statistics or from an area that complements the candidate's area of research interests in economics.

See the Center for Demographic Studies in the chapter "Special and Cooperative Programs" for further information.

## **Engineering**

Earl H. Dowell, Sc.D., *Dean* (305 Teer Engineering Library Building); Charles P. Yohn, B.S.E., *Associate Dean, Director of Development* (305 Teer Engineering Library Building)

The School of Engineering offers programs of study and research leading to the M.S. and Ph.D. degrees with a major in biochemical, biomedical, civil and environmental, electrical, and mechanical engineering and materials science. These programs are designed to provide: (1) development of depth and breadth in mathematics, computer science, the basic physical sciences, the life sciences where appropriate, and the engineering sciences; (2) mastery of an advanced body of knowledge in the candidate's chosen field of specialization or research; (3) experience in the art of engineering, including strong elements of intuition, imagination, and judgment; and (4) performance of original research which, in the case of the M.S. degree, demonstrates the ability to



advance knowledge in the area of professional study and, in the case of the Ph.D. degree, makes a significant contribution to the research literature through publication in a leading professional journal in the field. Engineering graduate students are expected to participate in seminars appropriate to their fields of study. A minimum of 30 units of earned graduate credit beyond the bachelor's degree is required for the M.S. degree: 12 in the major, 6 in related minor work (usually mathematics or natural science), 6 in either the major or minor subject or in other areas approved by the major department, and 6 for a research-based thesis. A nonthesis option requiring 30 units of course credit is available. Each of the departments imposes additional requirements in the exercise of this option. There is no language requirement for this degree. A minimum of 60 units of earned graduate credit beyond the bachelor's degree is required for the Ph.D. degree. In civil and environmental engineering, 12 units of course work beyond the master's degree are required to be in the major field, 6 in a related minor field, and 6 in either the major or minor field; in electrical engineering, 24 units are required in the major field and 12 units in a related minor field (often mathematics or natural science), 12 in either the major or minor subject or other areas approved by the major department, and 12 for a research-based dissertation. In biomedical and mechanical engineering and materials science there are no specific course requirements; each program is planned to meet individual needs. Doctoral students are required to pass qualifying and preliminary examinations which may be either written, oral, or a combination of written and oral components, at the discretion of the committee and the department.

In addition, the School of Engineering and the Fuqua School of Business offer an MBA/MS Joint-Degree Program. Further details about this program may be obtained from: Professor Miguel Medina, Director, MBA/MS Joint-Degree Program, Department of Civil and Environmental Engineering.

## ENGINEERING

**221. Computational Linear Algebra.** Linear vector spaces of real and complex  $n$ -tuples, norms, metrics, inner-products, basis vectors, rank and dimensionality; matrices as linear maps, rank and nullity; particular and general solutions of  $Ax=b$ ; factorization of matrices by successive transformations; solution of  $Ax=b$  by direct and iterative methods; special and general eigenvalue problems; diagonalization and tridiagonalization by similarity transformations; power methods; and computational complexities, storage requirements, convergence characteristics, error propagation, and the mathematical basis of the studied algorithms. Prerequisites: Mathematics 111 or equivalent, and knowledge of any algorithmic programming language. 3 units. *S. Utku*

## COURSES CURRENTLY UNSCHEDULED

### 222. Computer Solutions of Ordinary and Partial Differential Equations

## Biomedical Engineering

Associate Professor Trahey, *Director of Graduate Studies* (267 Engineering Annex); Professors Barr, Clark, Hammond, Jaszczak, Katz, McElhaney, Nolte, Plonsey, von Ramm, and Wolbarsht; Associate Professors Burdick, Floyd, Reichert, and S. Smith; Assistant Professors Cusma, Guilak, Henriquez, Jacobs, Krassowska, Myers, Setton, Truskey, and Wolf; Associate Research Professor Pasipoularides

Biomedical engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through experimental research to solutions of practical clinical problems. The goal of the graduate program in biomedical engineering is to combine training in advanced engineering, biomedical engineering, and the life sciences so that graduates of the program can contribute at the most advanced professional level. The doctoral dissertation should

demonstrate significant and original contributions to an interdisciplinary topic, accomplished as an independent investigator. The major, current research areas are: biochemical engineering, biofluid mechanics, biomechanics, biomedical materials, biomedical modeling, biosensors, biotechnology, data acquisition and processing, medical imaging, and electrophysiology. Every biomedical engineering graduate student is required to enroll in Biomedical Engineering 310 (M.S. students) or Biomedical Engineering 310, 311, and 312 (Ph.D. students).

**201L. Electrophysiology.** The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. Students choose a relevant topic area for detailed study and report. Not open to students who have taken Biomedical Engineering 101L or equivalent. 3 units; 4 units with laboratory. Variable credit. *Barr or Henriquez*

**204. Measurement and Control of Cardiac Electrical Events.** Design of biomedical devices for cardiac application based on a review of theoretical and experimental results from cardiac electrophysiology. Evaluation of the underlying cardiac events using computer simulations. Examination of electrodes, amplifiers, pacemakers, and related computer apparatus. Construction of selected examples. Prerequisites: Biomedical Engineering 101L and 163L or equivalents. 3 units. *Wolf*

**205L. Microprocessors and Digital Instruments.** Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects, including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. Prerequisites: Biomedical Engineering 163L, 164L and Engineering 53L or equivalents. 4 units. *Hammond*

**207. Transport Phenomena in Biological Systems.** An introduction to the modeling of complex biological systems using principles of transport phenomena and biochemical kinetics. Topics include the conservation of mass and momentum using differential and integral balances; rheology of Newtonian and non-Newtonian fluids; steady and transient diffusion in reacting systems; dimensional analysis; homogeneous versus heterogeneous reaction systems. Biomedical and biotechnological applications are discussed. C-L: Civil Engineering 207 and Mechanical Engineering 207. 3 units. *Katz or Truskey*

**208. Theoretical and Applied Polymer Science.** See C-L: Mechanical Engineering 211. 3 units. *H. Clark*

**209. Kinetics and Reactor Design.** Introduction to chemical and biochemical reaction stoichiometry and kinetics. Concepts of elementary reactions, reaction sequences, steady-state approximations, and rate-limiting steps. Ideal and non-ideal isothermal and non-isothermal reactor design and analysis. Homogeneous and heterogeneous reactor concepts, multiplicity, mass transfer limitations. Prerequisite: Mathematics 111 or consent of instructor. C-L: Civil Engineering 209. 3 units. *Staff*

**211. Theoretical Electrophysiology.** Advanced topics on the electrophysiological behavior of nerve and striated muscle. Source-field models for single-fiber and fiber bundles lying in a volume conductor. Forward and inverse models for EMG and ENG. Bidomain model. Model and simulation for stimulation of single-fiber and fiber bundle. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. Prerequisite: Biomedical Engineering 101L or 201L or equivalent. 4 units. *Barr or Krassowska*



**212. Theoretical Electrocardiography.** Electrophysiological behavior of cardiac muscle. Emphasis on quantitative study of cardiac tissue with respect to propagation and the evaluation of sources. Effect of junctions, inhomogeneities, anisotropy, and presence of unbounded extracellular space. Bidomain models. Study of models of arrhythmia, fibrillation, and defibrillation. Electrocardiographic models and forward simulations. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. Prerequisite: Biomedical Engineering 101L or 201L or equivalent. 4 units. *Barr*

**215. Biomedical Materials and Artificial Organs.** Chemical structures, processing methods, evaluation procedures, and regulations for materials used in biomedical applications. Applications include implant materials, components of ex vivo circuits, and cosmetic prostheses. Primary emphasis on polymer-based materials and on optimization of parameters of materials which determine their utility in applications such as artificial kidney membranes and artificial arteries. Prerequisite: Biomedical Engineering 83L, Chemistry 151L or Engineering 83L or consent of instructor. C-L: Mechanical Engineering 215. 3 units. *H. Clark or Reichert*

**216. Transport Phenomena in Cells and Organs.** Applications of the principles of mass and momentum transport to the analysis of selected processes of biomedical and biotechnological interest. Emphasis on the development and critical analysis of models of the particular transport process. Topics include: reaction-diffusion processes, transport in natural and artificial membranes, dynamics of blood flow, pharmacokinetics, receptor-mediated processes and macromolecular transport, normal and neoplastic tissue. Prerequisite: Biomedical Engineering 207 or equivalent. 3 units. *Truskey*

**222. Principles of Ultrasound Imaging.** Propagation, reflection, refraction, and diffraction of acoustic waves in biologic media. Topics include geometric optics, physical optics, attenuation, and image quality parameters such as signal-to-noise ratio, dynamic range, and resolution. Emphasis is placed on the design and analysis of medical ultrasound imaging systems. Prerequisites: Mathematics 111 and Physics 52L. 3 units. *von Ramm*

**223. Cellular and Integrative Cardiovascular Physiology and Biophysics.** Electrical and mechanical properties of the heart at the cellular and organ levels; reflex control of cardiac output; the heart as an endocrine organ; interaction between heart, kidney, and lung; comparative cardiac physiology. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent; consent of instructor or graduate status. C-L: Cell Biology 223. 3 units. *Benjamin and staff*

**230. Biomechanics.** Kinematic models of human motions, mechanical properties of bone and soft tissues, load directed growth mechanisms, human tolerance to impact and vibration, head injury criteria applied to helmet design. 3 units. *McElhaney*

**231. Intermediate Biomechanics.** Biomechanics of hard and soft tissues: nonlinear viscoelastic behavior of tendon and ligament; poroelastic behavior of cartilage and meniscus; continuum modeling of bone. Emphasis will be placed on experimental techniques used to evaluate these tissues. Student seminars on topics in applied biomechanics will be included. Prerequisites: Biomedical Engineering 110L or Engineering 75L or equivalent, and Biomedical Engineering 83L or Engineering 83L or equivalent. 3 units. *Myers*

**233. Modern Diagnostic Imaging Systems.** The underlying concepts and instrumentation of several modern medical imaging modalities. Review of applicable linear systems theory and relevant principles of physics. Modalities studied include X-ray radiography (conventional film-screen imaging and modern electronic imaging), com-



puterized tomography (including the theory of reconstruction), and nuclear magnetic resonance imaging. Prerequisite: junior or senior standing. 3 units. *Floyd*

**235. Acoustics and Hearing.** The generation and propagation of acoustic (vibrational) waves and their reception and interpretation by the auditory system. Topics under the heading of generation and propagation include free and forced vibrations of discrete and continuous systems, resonance and damping, and the wave equation and solutions. So that students may understand the reception and interpretation of sound, the anatomy and physiology of the mammalian auditory system are presented; and the mechanics of the middle and inner ears are studied. Prerequisites: Mathematics 111 and Physics 52L or equivalents. 3 units. *Trahey*

**237. Biosensors.** Biosensors defined as the use of biospecific recognition mechanisms in the detection of analyte concentration. The basic principles of protein binding with specific reference to enzyme-substrate, lectin-sugar, antibody-antigen, and receptor-transmitting binding. Simple surface diffusion and absorption physics at surfaces with particular attention paid to surface binding phenomena. Optical, electrochemical, gravimetric, and thermal transduction mechanisms which form the basis of the sensor design. Prerequisites: Biomedical Engineering 215 and consent of instructor. 3 units. *Reichert*

**241. Artificial Intelligence in Medicine.** Basic concepts of artificial intelligence (AI) and in-depth examination of medical applications of AI. Knowledge of heuristic programming; brief examination of classic AI programming languages (LISP and PROLOG) and AI programming; rule-based systems and cognitive models. 3 units. *Hales or Hammond*

**243. Introduction to Medical Informatics.** An introduction to medical informatics: an in-depth study of the use of computers in biomedical applications. Hardware, software, and applications programming. Data collection, analysis, and presentation studied within application areas such as patient monitoring, computer-based medical records, computer-aided decision making, computer-aided instruction, quality assurance laboratory systems, wave form analysis, hospital information systems, and medical information systems. 3 units. *Hales or Hammond*

**244. Mathematical Models of Physiological Systems.** Mathematical modeling and computer simulation of physiological and other biomedical systems. Formulation of quantitative models of physiological processes using methods drawn from a variety of engineering disciplines including transport phenomena, feedback control, and continuum mechanics. Digital techniques for the solution of coupled nonlinear equations, emphasizing systems of ordinary and partial differential equations. Selected readings from the literature covering current models of cardiovascular, renal, neural, respiratory, and sensory systems. Prerequisite: Mathematics 111 or equivalent. 3 units. *Pasipoularides*

**246. Computational Methods in Biomedical Engineering.** Introduction to practical computational methods for data analysis and simulation with a major emphasis on implementation. Methods include numerical integration and differentiation, extrapolation, interpolation, splining FFTs, convolution, ODEs, and simple one- and two-dimensional PDEs using finite differencing. Introduction to concepts for optimizing codes on a CRAY-YMP. Examples from biomechanics, electrophysiology, and imaging. Project work included and students must have good working knowledge of Unix, Fortran, or C. Intended for graduate students and seniors who plan on attending graduate school. Prerequisite: Engineering 53L or equivalent, Mathematics 111 or equivalent, or consent of instructor. 3 units. *Henriquez*

**250. Cardiovascular Mechanics.** Mechanical principles and their applications in the human circulatory system. The coupling of solid and fluid behavior in cardiovascular

organs is emphasized. Topics include: gravity and the circulation, kinematics of blood flow and circulatory volume balances, peripheral resistance, wall stresses and deformations, cardiac cycle and cardiac work, circulatory wave propagation, unsteady velocity profiles and boundary layers. Special student projects involve the design of diagnostic and therapeutic instruments and devices for cardiovascular applications. Prerequisites: Biomedical Engineering 110L and Mathematics 111 or equivalent. 3 units. *Pasipoularides*

**255. Safety of Medical Devices.** Safety of medical devices such as prosthetic heart valves and silicone breast implants. Engineering analysis of the safety of biomedical instrumentation in the context of the regulations of the U.S. Food and Drug Administration. Engineering performance standards and FDA requirements for clinical trials for selected medical devices such as medical diagnostic ultrasound, surgical lasers, and prosthetic heart valves. Students will prepare a mock application for FDA premarket approval to demonstrate safety of a selected medical device. Prerequisite: junior or senior standing. 3 units. *S. Smith*

**264. Medical Instrument Design.** General principles of signal acquisition, amplification processing, recording, and display in medical instruments. System design, construction, and evaluation techniques will be emphasized. Methods of real-time signal processing will be reviewed and implemented in the laboratory. Each student will design, construct, and demonstrate a functional medical instrument and collect and analyze data with that instrument. Formal write-ups and presentations of each project will be required. Prerequisite: Biomedical Engineering 164L or equivalent or senior standing. 3 units. *Trahey*

**265. Advanced Topics in Biomedical Engineering.** Advanced subjects related to programs within biomedical engineering tailored to fit the requirements of a small group. Consent of instructor required. Variable credit. *Staff*

#### **For Graduates**

**301, 302. Cellular and Biosurface Engineering Seminar.** Current topics in cellular and biosurface engineering. Theory and practice. Weekly seminar series. 1 unit each. *Reichert or Truskey*

**310, 311, 312. Engineering Education.** Under the direction of the professor instructing a course, a student engages in lecture preparation and delivery, laboratory supervision, examination and homework preparation and grading, and other educational activities. Designed to prepare students for instructing courses at the university level and to provide a deeper level of understanding of the course material. For the M.S. degree in Biomedical Engineering, BME 310 is required. For the Ph.D. degree in Biomedical Engineering, BME 310, 311, and 312 are all required, but do not count toward the 48 required course credits. Credit/no credit. 3 units each. *Staff*

**320. Medical Ultrasound Transducers.** A study of the design, fabrication, and evaluation of medical ultrasound transducers. Topics include wave propagation in piezoelectric crystals, Mason and KLM circuit models, linear arrays and two-dimensional arrays, piezoelectric ceramic/epoxy composite materials, piezoelectric polymers, and photo-acoustic materials. Consent of instructor required. 3 units. *S. Smith*

**330. Finite Element Method for Biomedical Engineers.** The finite element method with an emphasis on applications to biomedical engineering. Several detailed examples illustrate the finite element analysis process, which includes setting up a mathematical description of the problem, putting it into a form suitable for finite element solution, solving the discretized problem, and using advanced computer codes to check the correctness of the numerical results. Consent of instructor required. 3 units. *Staff*



**331. Viscoelasticity.** Viscoelasticity of hard and soft tissue solids and composite structures. Linear and nonlinear one-dimensional viscoelastic behavior, internal damping, and three-dimensional viscoelasticity. Approximation techniques for determination of viscoelastic constitutive equations from experimental data. Mathematical formulations for the characterization of the dynamic behavior of biologic structures. Consent of instructor required. 3 units. *Myers*

**333. Biomedical Imaging.** A study of the fundamentals of information detection, processing, and presentation associated with imaging in biology and medicine. Analysis of coherent and incoherent radiation and various image generation techniques. Design and analysis of modern array imaging systems as well as systems. 3 units. *von Ramm*

**399. Special Readings in Biomedical Engineering.** Individual readings in advanced study and research areas of biomedical engineering. Approval of director of graduate studies required. 1 to 3 units each. Variable credit. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**202. Biomedical Transfer Processes**

**206L. Microprocessors and Digital Instruments**

## Civil and Environmental Engineering

Professor Petroski, *Chair* (121 Engineering); Associate Professor Peirce, *Director of Graduate Studies* (139A Engineering); Professors Haff, Melosh, S. Utku, Vesilind, and J. F. Wilson; Associate Professors Hueckel, Kabala, Medina, Pas, and Reckhow; Assistant Professors Boadu, Faust, Jacobs, Laursen, and Virgin; Professor Emeritus Brown; Adjunct Associate Professors Piver and B. Utku; Visiting Professor Narayanan

Civil and environmental engineering extends across mathematics, the natural sciences including physics, biology, and chemistry, and the social and management sciences. Civil and environmental engineers develop expertise in these disciplines to research, plan, design, construct, and analyze solutions to technical problems faced throughout society. These solutions vary widely in nature, size, and scope: space satellites and launching facilities, environmental systems and controls to protect public health, nuclear and conventional power plant structures, bridges, dams, buildings, tunnels, highways, and mass transportation systems.

Six major specialty areas at Duke enjoy national and international reputations for quality:

- **engineering mechanics:** the study of the behavior and behavior control of solid and fluid systems under a broad range of design and extreme loading conditions; the development of new computational paradigms for complex mechanical systems;
- **environmental engineering:** the study of the disposal of hazardous waste, solid waste processing, pollutant fate and transport in water, soil, and air, and water and wastewater treatment to protect public health and the environment;
- **geomechanics:** the study of the response of soils and rocks to mechanical, hydraulic, and environmental loadings and its mathematical modeling;
- **structural engineering:** the study of behavior of structures and materials, the safe and economical design of engineered structures, fundamentals of adaptive structures, use of adaptive structures technology in precision and vibration control of space structures, and vibration inhibition in buildings subjected to seismic and wind excitations;
- **transportation and systems engineering:** the modeling and analysis of large and complex mechanical, environmental, and human systems to support decision



making and policy analysis, complex decision making, pattern formation, and nonlinearity using computer simulation;

- **water resources engineering:** the analysis of use, preservation, and efficient management of surface and groundwater supplies.

Environmental mechanics is an interdisciplinary area of interest to many civil and environmental engineering faculty. The emphasis is on the mechanics of chemically and/or biologically interacting solids and liquids, including transport phenomena in porous media, environmental geomechanics, degradation and aging of structures and materials due to chemically aggressive environments, and natural and engineered environmental processes including sedimentation, coagulation, mixing, sludge processing, water and wastewater treatment, and barriers to prevent pollutant transport.

Laboratory facilities in the department are competitive with those found in major research universities worldwide. Computers are used for data collection and analysis, and a wide range of physical, chemical, and biological testing equipment is used in the laboratory for teaching and research activities. Advanced-graphics computer systems are also available. Project-specific measurement equipment is designed, constructed, and applied in many of the specialty areas mentioned above.

Under the Reciprocal Agreement with Neighboring Universities, a student may enroll in classes offered by the University of North Carolina at Chapel Hill and North Carolina State University in Raleigh. Although related work normally is taken in the natural sciences, computer sciences, or mathematics, a student with interests in the social or management sciences may take relevant work in these areas.

**201. Advanced Mechanics of Solids.** Tensor fields and index notation. Analysis of states of stress and strain. Conservation laws and field equations. Constitutive equations for elastic, viscoelastic, and elastic-plastic solids. Formulation and solution of simple problems in elasticity, viscoelasticity, and plasticity. 3 units. *Hueckel, Laursen, or Petroski*

**203. Plasticity.** Inelastic behavior of soils and engineering materials. Yield criteria. Flow rules. Concepts of perfect plasticity and plastic hardening. Methods of rigid-plasticity. Limit analysis. Isotropic and kinematic hardening. Plastic softening. Diffused damage. Thermo-plasticity. Visco-plasticity. Prerequisite: Civil Engineering 201 or consent of instructor. 3 units. *Hueckel*

**204. Plates and Shells.** Differential equation and extremum formulations of linear equilibrium problems of Kirchhoffian and non-Kirchhoffian plates of isotropic and orthotropic material. Solution methods. Differential equation formulation of thin shell problems in curvilinear coordinates; membrane and bending theories; specialization for shallow shells, shells of revolution, and plates. Extremum formulation of shell problems. Solution methods. Prerequisites: Engineering 75L or 135 and Mathematics 111. 3 units. *S. Utku*

**205. Elasticity.** Introduction to linear theory of elasticity. Constitutive equations for anisotropic and isotropic elastic solids. Formulation and solution of torsion, bending, and flexure problems. Plane, axisymmetric, and three-dimensional problems. 3 units. *Petroski*

**207. Transport Phenomena in Biological Systems.** See C-L: Biomedical Engineering 207; also C-L: Mechanical Engineering 207. 3 units. *Katz or Truskey*

**209. Kinetics and Reactor Design.** Prerequisite: Mathematics 111 or consent of instructor. See C-L: Biomedical Engineering 209. 3 units. *Staff*

**210. Intermediate Dynamics.** See C-L: Mechanical Engineering 210. 3 units. *Hall or Knight*

**215. Engineering Systems Analysis.** Fundamental concepts and tools for engineering systems analysis, including optimization techniques and decision analysis. System definition and model formulation, optimization by calculus, linear programming, integer programming, separable integer programming, nonlinear programming, network analysis, dynamic programming, and decision analysis. Application to diverse engineering systems. 3 units. *Pas*

**217. Transportation Systems Analysis.** The transportation systems planning process. Quantitative analysis; mathematical modeling and computer simulation techniques for short-and long-range planning and evaluation of transportation systems. Prerequisite: (or corequisite) Civil Engineering 116 or consent of instructor. 3 units. *Pas*

**218. Engineering Management and Project Evaluation.** Economics and statistical analysis. Economic impact assessment, supply and demand forecasting, benefit/cost analysis, economic incentives, public and private finance, input/output analysis. Data organization, distributions, estimates of parameters, hypothesis testing, analysis of variance, and experimental design. 3 units. *Pearce*

**220. Water Resources Systems Planning and Management.** Focus on the development and application of mathematical modeling techniques to water resources systems problems. Deterministic and stochastic river basin modeling, irrigation planning and modeling, water quality prediction and management, wetlands management, the optimal expansion of existing water resources systems and reservoir operations. Emphasis on development and application of optimization models for the planning and management of complex water resources systems involving the interaction of groundwater and surface water resources. Mathematical techniques include linear and dynamic programming, Monte Carlo simulation, simulated annealing, nonlinear optimization and stochastic optimization. Prerequisites: Civil Engineering 123L and Civil Engineering 215 or Engineering 115 or equivalent. 3 units. *Jacobs*

**221. Engineering Systems Reliability, Safety, and Risk Assessment.** Introduction to the concepts of design reliability and safety. Topics include: concepts of probability in engineering planning and design, decision analysis and assessment of reliability, modeling and analysis of uncertainty, reliability-based design, multiple failure mode analysis, redundant and nonredundant systems, and fault tree analysis. Emphasis on determining the probability of failure for numerous engineering systems including structural systems, infrastructure systems, water treatment systems, environmental systems, and transportation networks. Prerequisite: Mathematics 111 or consent of instructor. 3 units. *Jacobs*

**225. Dynamic Engineering Hydrology.** Dynamics of the occurrence, circulation, and distribution of water; climate, hydrometeorology, geophysical fluid motions. Precipitation, surface runoff and stream flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. Prerequisite: Civil Engineering 122L or consent of instructor. 3 units. *Medina*

**227. Groundwater Hydrology and Contaminant Transport.** Review of surface hydrology and its interaction with groundwater. The nature of porous media, hydraulic conductivity, and permeability. General hydrodynamic equations of flow in isotropic and anisotropic media. Water quality standards and contaminant transport processes: advective-dispersive equation for solute transport in saturated porous media. Analytical and numerical methods, selected computer applications. Deterministic versus stochastic models. Applications: leachate from sanitary landfills, industrial lagoons and ponds, subsurface wastewater injection, monitoring of groundwater contamination. Conjunctive surface-subsurface models. Prerequisite: Civil Engineering 123L or consent of instructor. 3 units. *Medina*



**228L. Sludge Management and Disposal.** Production and characterization of residues from wastewater treatment. Theory of solid/water interfaces and vicinal water. Gravitational thickening and dewatering. Anaerobic stabilization, incineration, composting, and other treatment processes. Ultimate disposal. Prerequisites: Civil Engineering 124L or equivalent and consent of instructor. 3 units. *Vesilind*

**233. Prestressed Concrete Design.** A critical review of research and recent developments in prestressed concrete design. Prestressed tanks, beams, and columns; partial prestressing and composite design. Prerequisite: Civil Engineering 133L. 3 units. *Narayanan*

**237. Advanced Soil Mechanics.** Characterization of behavior of geomaterials. Stress-strain incremental laws. Nonlinear elasticity, hypo-elasticity, plasticity and viscoplasticity of geomaterials; approximated laws of soil mechanics; fluid-saturated soil behavior; cyclic behavior of soils; liquefaction and cyclic mobility; elements of soil dynamics; thermal effects on soils. Prerequisite: Civil Engineering 139L or equivalent. 3 units. *Hueckel*

**240. Fate of Organic Chemicals in the Aquatic Environment.** Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in surface and groundwaters and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatography and mass spectrometry. Prerequisites: university-level general chemistry and organic chemistry within last four years. C-L: Environment 240. 3 units. *Dubay and Faust*

**241. Atmospheric Chemistry and Air Pollution.** Chemical kinetics and equilibrium applied to the mechanistic and quantitative description of processes affecting the fates of anthropogenic and natural chemicals in the troposphere, on local, regional, and global scales. Direct photolysis; gas-phase photo-formation and fates of ozone, radicals, and other oxidants; gas-phase oxidations of volatile organic compounds; gas-to-drop partitioning; aqueous-phase photoformation and fates of hydrogen peroxide, radicals, and other oxidants in the aqueous phases of clouds, fogs, and aerosols; effects of aqueous-phase reactions on the chemical composition of the troposphere; gas-phase and aqueous-phase oxidations of organic and inorganic compounds; stratospheric ozone depletion. Prerequisites: university-level general chemistry and organic chemistry within last four years. C-L: Environment 241. 3 units. *Faust*

**242. Environmental Aquatic Chemistry.** Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, adsorption, and heterogeneous reactions. Prerequisite: university-level general chemistry within last four years. C-L: Environment 242. 3 units. *Faust*

**243. Physicochemical Unit Operations in Water Treatment.** Fundamental bases for design of water and waste treatment systems, including transport, mixing, sedimentation and filtration, gas transfer, coagulation, and absorption processes. Emphasis on physical and chemical treatment combinations for drinking water supply. Prerequisite: Civil Engineering 124L. 3 units. *Kabala*

**244. Applied Microbial Processes.** Existing and novel microbial processes as they pertain to biotechnological products, specialty bioconversions, and to treat or exploit wastes. Concepts of microbiology, chemical engineering, the stoichiometry and kinetics



of complex microbial metabolism, and process analysis. Specific processes such as carbon oxidation, vinegar and alcohol production, nitrification, methane production, biological electricity generation, recombinant protein secretion, and wastewater treatment in long-term space travel are discussed. Consent of instructor required. 3 units. *Staff*

**245. Pollutant Transport Systems.** Distribution of pollutants in natural waters and the atmosphere; diffusive and advective transport phenomena within the natural environment and through artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. Prerequisites: Civil Engineering 122L and Mathematics 111 or equivalents. 3 units. *Medina*

**246. Water Supply Engineering Design.** The study of water resources and municipal water requirements including reservoirs, transmission, treatment and distribution systems; methods of collection, treatment, and disposal of municipal and industrial wastewaters. The course includes the preparation of a comprehensive engineering report encompassing all aspects of municipal water and wastewater systems. Field trips to be arranged. Prerequisite: Civil Engineering 124L or consent of instructor. 3 units. *Vesilind*

**248. Solid Waste Engineering.** Engineering design of material and energy recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Application of systems analysis to collection of municipal refuse. Major design project in solid waste management. Prerequisite: Civil Engineering 124L or consent of instructor. C-L: Environment 248. 3 units. *Vesilind*

**249. Control of Hazardous and Toxic Waste.** Engineering solutions to industrial and municipal hazardous waste management problems. Handling, transportation, storage, and disposal technologies. Biological, chemical, and physical processes. Upgrading an abandoned disposal site. Economic and regulatory aspects. Case studies. Consent of instructor required. 3 units. *Peirce*

**251. Systematic Engineering Analysis.** Mathematical formulation and numerical analysis of engineering systems with emphasis on applied mechanics. Equilibrium and eigenvalue problems of discrete and distributed systems; properties of these problems and discretization of distributed systems in continua by the trial functions with undetermined parameters. The use of weighted residual methods, finite elements, and finite differences. Prerequisite: senior or graduate standing. 3 units. *S. Ulku*

**252. Buckling of Engineering Structures.** An introduction to the underlying concepts of elastic stability and buckling, development of differential equation and energy approaches, buckling of common engineering components including link models, struts, frames, plates, and shells. Consideration will also be given to inelastic behavior, postbuckling, and design implications. Prerequisite: Civil Engineering 131L or consent of instructor. C-L: Mechanical Engineering 252. 3 units. *Virgin*

**254. Introduction to the Finite Element Method.** Investigation of the finite element method as a numerical technique for solving linear ordinary and partial differential equations, using rod and beam theory, heat conduction, elastostatics and dynamics, and advective/diffusive transport as sample systems. Emphasis placed on formulation and programming of finite element models, along with critical evaluation of results. Topics include: Galerkin and weighted residual approaches, virtual work principles, discretization, element design and evaluation, mixed formulations, and transient analysis. Prerequisites: a working knowledge of ordinary and partial differential equations, numerical methods, and programming in FORTRAN. 3 units. *Laursen*

**255. Nonlinear Finite Element Analysis.** Formulation and solution of nonlinear initial/boundary value problems using the finite element method. Systems include

nonlinear heat conduction/diffusion, geometrically nonlinear solid and structural mechanics applications, and materially nonlinear systems (for example, elastoplasticity). Emphasis on development of variational principles for nonlinear problems, finite element discretization, and equation-solving strategies for discrete nonlinear equation systems. Topics include: Newton-Raphson techniques, quasi-Newton iteration schemes, solution of nonlinear transient problems, and treatment of constraints in a nonlinear framework. An independent project, proposed by the student, is required. Prerequisite: Civil Engineering 254 or consent of instructor. 3 units. *Laursen*

**265. Advanced Topics in Civil and Environmental Engineering.** Opportunity for study of advanced subjects relating to programs within the civil and environmental engineering department tailored to fit the requirements of individuals or small groups. Variable credit. *Staff*

**281. Experimental Systems.** Formulation of experiments; Pi theorem and principles of similitude; data acquisition systems; static and dynamic measurement of displacement, force, and strain; interfacing experiments with digital computers for data storage, analysis, and plotting. Students select, design, perform, and interpret laboratory-scale experiments involving structures and basic material behavior. Prerequisite: senior or graduate standing in engineering or the physical sciences. 3 units. *J. F. Wilson*

**283. Structural Dynamics.** Formulation of dynamic models for discrete and continuous structures, normal mode analysis, deterministic and stochastic responses to shocks and environmental loading (earthquakes, winds, and waves), introduction to nonlinear dynamic systems, analysis and stability of structural components (beams and cables and large systems such as offshore towers, moored ships, and floating platforms). 3 units. *J. F. Wilson*

**300. Teaching Engineering.** Designed for engineering graduate students contemplating careers in academia. Topics include teaching skills, philosophy of higher education, academic integrity, research ethics, operation of a modern university, student development and learning, evaluation of performance, conducting teaching laboratories, advising, and other topics. No credit. *Vesilind*

**301, 302. Graduate Colloquium.** Current topics in civil and environmental engineering theory and practice. Weekly seminar series. No credit. *Peirce*

**399. Special Readings in Civil and Environmental Engineering.** Special individual readings in a specific area of study in civil and environmental engineering. Approval of director of graduate studies required. 1 to 3 units. Variable credit. *Graduate faculty*

## COURSES CURRENTLY UNSCHEDULED

**202. Advanced Mechanics of Solids II**

**212. Mechanical Behavior and Fracture of Materials**

**216. Transportation Planning and Policy Analysis**

**222. Open Channel Flow**

**223. Flow Through Porous Media**

**226. Operational Hydrology**

**231. Structural Engineering Analysis**

**232. Reinforced Concrete Design**

**234. Advanced Structural Design in Metals**

**235. Foundation Engineering**



- 236. Earth Structures
- 238. Rock Mechanics
- 239. Physical Properties of Soils
- 247. Air Pollution Control
- 257. Structural Optimization
- 258. Analysis of Dynamic and Nonlinear Behavior of Structures
- 337. Elements of Soil Dynamics
- 350. Advanced Engineering Analysis

## Electrical Engineering

Professor Gelenbe, *Chair*; Professor Nolte, *Director of Graduate Studies* (172 Engineering); Professors Casey, Fair, Joines, Marinos, and Wang; Associate Professors Alexandrou, Board, Kedem, Krolik, and Massoud; Assistant Professors Daniels-Race, George, Hansen, and Overhauser; Professors Emeritus Owen and Wilson; Assistant Research Professor Ybarra; Adjunct Professors Glomb, Lontz, Marin, and Strosio; Adjunct Associate Professors Derby and Kanopoulos; Adjunct Assistant Professors Bottomley, Bushnell, Goodwin-Johansson, Gun, Loeb, Onvural, Palmer, Rindos, Spano, Strole, and Walsh; Visiting Professors Kaiser and McCumber

A student may specialize in any one of the following fields in working toward either the M.S. or the Ph.D. degree with a major in electrical engineering: computer engineering, computer architecture, fault-tolerant computer systems, scientific computing, parallel processing, VLSI CAD tools, signal processing, digital speech processing, signal detection and estimation, ocean acoustic signal processing, image processing, solid-state electronics, integrated circuit processing and process simulation, molecular-beam epitaxy, III-V compound semiconductor materials and devices, machine intelligence, applications of electromagnetic fields and waves. Recommended prerequisites for the graduate courses in electrical engineering include a knowledge of basic mathematics and physics, electrical networks, electromagnetic and system theory. Students in doubt about their background for enrollment in specific courses should discuss the matter with the director of graduate studies. The M.S. degree program includes either a thesis or a project and an oral examination. A qualifying examination is required for the Ph.D. degree program. This examination is intended to test both the breadth and depth of the student's understanding of basic electrical engineering concepts. There is no foreign language requirement.

**211. Quantum Mechanics.** Discussion of wave mechanics including elementary applications, free particle dynamics, Schrödinger equation including treatment of systems with exact solutions, and approximate methods for time-dependent quantum mechanical systems with emphasis on quantum phenomena underlying solid-state electronics and physics. Prerequisite: Mathematics 111 or equivalent. 3 units. *Staff*

**214. Introduction to Solid-State Physics.** Discussion of solid-state phenomena including crystalline structures, X-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis on understanding electrical and optical properties of solids. Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Physics 214. 3 units. *Teitsworth*

**215. Semiconductor Physics.** A quantitative treatment of the physical processes that underlie semiconductor device operation. Topics include band theory and conduction phenomena; equilibrium and nonequilibrium charge carrier distributions; charge gen-



eration, injection, and recombination; drift and diffusion processes. Prerequisite: Electrical Engineering 211 or consent of instructor. 3 units. *Daniels-Race*

**216. Devices for Integrated Circuits.** Derivation of basic semiconductor properties such as the effective mass, effective density of states, SHR recombination, avalanche breakdown and energy-band diagrams. Application of the continuity equation, Gauss' law, and Poisson's equation to obtain the I-V and C-V behavior of Si and GaAs Schottky barriers, GaAs MESFETs; Si JFETs, bipolar transistors and MOSFETs. Relation of device physics to SPICE parameters. Four laboratory exercises. 3 units. *Casey*

**217. Analog Integrated Circuits.** Analysis and design of bipolar and CMOS analog integrated circuits. SPICE device models and circuit macromodels. Classical operational amplifier structures, current feedback amplifiers, and building blocks for analog signal processing, including operational transconductance amplifiers and current conveyors. Biasing issues, gain and bandwidth, compensation, and noise. Influence of technology and device structure on circuit performance. Extensive use of industry-standard CAD tools, such as Analog Workbench. Prerequisite: Electrical Engineering 216. 3 units. *Staff*

**218. Integrated Circuit Engineering.** Basic processing techniques and layout technology for integrated circuits. Photolithography, diffusion, oxidation, ion implantation, and metallization. Design, fabrication, and testing of integrated circuits. Prerequisite: Electrical Engineering 216. 3 units. *Fair*

**219. Digital Integrated Circuits.** Analysis and design of digital integrated circuits. IC technology. Switching characteristics and power consumption in MOS devices, bipolar devices, and interconnects. Analysis of digital circuits implemented in NMOS, CMOS, TTL, ECL, and BiCMOS. Propagation delay modeling. Analysis of logic (inverters, gates) and memory (SRAM, DRAM) circuits. Influence of technology and device structure on performance and reliability of digital ICs. SPICE modeling. Prerequisites: Electrical Engineering 151 and 216. 3 units. *Massoud*

**243. Pattern Classification and Recognition.** Parameter estimation and supervised learning, nonparametric techniques, linear discriminant functions, clustering, language theory related to pattern recognition, examples from areas such as character and severe weather recognition, classification of community health data, recognition of geometrical configurations, algorithms for recognizing low resolution touch-sensor array signatures and 3-D objects. Consent of instructor required. 3 units. *Wang*

**245. Digital Control Systems.** Review of traditional techniques used for the design of discrete-time control systems; introduction of "nonclassical" control problems of intelligent machines such as robots. Limitations of the assumptions required by traditional design and analysis tools used in automatic control. Consent of instructor required. 3 units. *Staff*

**246. Optimal Control.** Review of basic linear control theory and linear/nonlinear programming. Dynamic programming and the Hamilton-Jacobi-Bellman Equation. Calculus of variations. Hamiltonian and costate equations. Pontryagin's Minimum Principle. Solution to common constrained optimization problems. This course is designed to satisfy the need of several engineering disciplines. Prerequisite: Electrical Engineering 141 or equivalent. C-L: Mechanical Engineering 232. 3 units. *Rindos*

**251. Advanced Digital System Design.** Theory and hands-on experience in advanced digital system design. High-speed design, high complexity design (more than 10,000 gates), implementation technology selection, system modeling, power and clock distribution, line termination, and cooling. Case studies and demonstrations. Extensive use of CAD tools for logic minimization, logic synthesis, and system simulation. Rapid system prototyping with off-the-shelf and custom components. Laboratory exercises

and a semester project. Prerequisites: Electrical Engineering 151 and 163L (or Biomedical Engineering 163L with consent of instructor). 3 units. *Kanopoulos*

**252. Advanced Digital Computer Architecture.** A second course on computer architecture. Definition of high-performance computing. The von Neumann bottleneck, Amdahl's law. Computer taxonomies. Memory organization, Princeton/Harvard architectures, caches, and virtual memory. Instruction pipelining. Vector processing. Instruction sets (RISC/CISC/VLIW). Parallel processing (SIMD/MIMD). Multiprocessor interconnection networks, communications, and synchronization. Prerequisite: Computer Science 104 or Electrical Engineering 152. 3 units. *Board*

**253. Parallel System Performance.** Intrinsic limitations to computer performance. Amdahl's Law and its extensions. Components of computer architecture and operating systems, and their impact on the performance available to applications. Intrinsic properties of application programs and their relation to performance. Task graph models of parallel programs. Estimation of best possible execution times. Task assignment and related heuristics. Load balancing. Specific examples from computationally intensive, I/O intensive, and mixed parallel and distributed computations. Global distributed system performance. Prerequisites: Computer Science 110; Electrical Engineering 151 and 152. 3 units. *Gelenbe*

**254. Fault-Tolerant and Testable Computer Systems.** Faults and failure mechanisms, test generation techniques and diagnostic program development for detection and location of faults in digital networks; design for testability, redundancy techniques, self-checking and fail-safe networks, fault-tolerant computer architectures. Prerequisite: Electrical Engineering 151 or equivalent. C-L: Computer Science 225. 3 units. *Marinos*

**255. Mathematical Methods for Systems Analysis I.** Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four semesters of college mathematics. C-L: Computer Science 226. 3 units. *Trivedi*

**257. Performance and Reliability of Computer Networks.** Methods for performance and reliability analysis of local area networks as well as wide area networks. Probabilistic analysis using Markov models, stochastic Petri nets, queuing networks, and hierarchical models. Statistical analysis of measured data and optimization of network structures. Prerequisites: Electrical Engineering 156 and 255. 3 units. *Trivedi*

**258. Artificial Neural Networks.** Elementary biophysical background for signal propagation in natural neural systems. Artificial neural networks (ANN) and the history of computing; early work of McCulloch and Pitts, of Kleene, of von Neumann and others. The McCulloch and Pitts model. The connectionist model. The random neural network model. ANN as universal computing machines. Associative memory; learning; algorithmic aspects of learning. Complexity limitations. Applications to pattern recognition, image processing and combinatorial optimization. Prerequisite: Electrical Engineering 151. 3 units. *Gelenbe*

**261. Full Custom VLSI Design.** A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 163L (or Biomedical Engineering 163L with consent of instructor) or equivalent. 3 units. *Overhauser*

**262. Advanced VLSI Design and Test.** An advanced course in VLSI design with emphasis on the design of application specific IC's (ASIC) for a given set of specifica-



tions. Discussions of available technologies for ASIC implementation and tradeoffs in using these technologies. Static and dynamic CMOS design of commonly used circuits (adders, multipliers, RAM, pads). Packaging and testing of ASIC's with emphasis on functional and performance verification. This course stresses the design of ASIC's within a systems design environment and with the use of appropriate design tools that can be used to validate a design based on a given set of design specifications. Prerequisite: Electrical Engineering 261. 3 units. *Kanopoulos*

**266. VLSI Design Verification Techniques.** VLSI verification tool design. Design and capabilities of circuit simulation, timing simulation, logic simulation, and functional simulation. Techniques applied in timing verification and other static verification tools. Parallel processing and its application to simulation. Physical design issues related to verification. Prerequisite: Electrical Engineering 261, working knowledge of C. 3 units. *Overhauser*

**269. VLSI Chip Testing.** Introduction to VLSI chip and system testing. Testing theory, strategies, and fault identification. Hands-on testing experience with faulty chips and systems, chips designed in Electrical Engineering 261, and testing equipment available in the department. Prerequisite: Electrical Engineering 261. 3 units. *Overhauser*

**271. Electromagnetic Theory.** The classical theory of Maxwell's equations; electrostatics, magnetostatics, boundary value problems including numerical solutions, currents and their interactions, and force and energy relations. Three class sessions. Consent of instructor required. 3 units. *Joines*

**272. Electromagnetic Communication Systems.** Review of fundamental laws of Maxwell, Gauss, Ampere, and Faraday. Elements of waveguide propagation and antenna radiation. Analysis of antenna arrays by images. Determination of gain, loss, and noise temperature parameters for terrestrial and satellite electromagnetic communication systems. Prerequisite: Electrical Engineering 170L or 271. 3 units. *Joines*

**273. Optical Communication Systems.** Mathematical methods, physical ideas, and device concepts of optoelectronics. Maxwell's equations, and definitions of energy density and power flow. Transmission and reflection of plane waves at interfaces. Optical resonators, waveguides, fibers, and detectors are also presented. Prerequisite: Electrical Engineering 170L or equivalent. 3 units. *Joines*

**274. Modern Optics I.** Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications of these concepts to lasers and modern optical devices. Lecture and laboratory projects. C-L: Physics 185. 3 units. *Guenther*

**275. Microwave Electronic Circuits.** Microwave circuit analysis and design techniques. Properties of planar transmission lines for integrated circuits. Matrix and computer-aided methods for analysis and design of circuit components. Analysis and design of input, output, and interstage networks for microwave transistor amplifiers and oscillators. Topics on stability, noise, and signal distortion. Prerequisite: Electrical Engineering 170L or equivalent. 3 units. *Joines*

**276. Laser Physics.** Prerequisites: Electrical Engineering 170L or Physics 182 and Electrical Engineering 211 or Physics 211. See C-L: Physics 261. 3 units. *Skatrud*

**281. Random Signals and Noise.** Introduction to mathematical methods of describing and analyzing random signals and noise. Review of basic probability theory; joint, conditional, and marginal distributions; random processes. Time and ensemble averages, correlation, and power spectra. Optimum linear smoothing and predicting filters. Introduction to optimum signal detection, parameter estimation, and statistical signal processing. Prerequisite: Mathematics 135 or Statistics 113. 3 units. *Hansen*



**282. Digital Signal Processing.** Introduction to the fundamentals of processing signals by digital techniques with applications to practical problems. Discrete time signals and systems, elements of the Z-transform, discrete Fourier transforms, digital filter design techniques, fast Fourier transforms, and discrete random signals. 3 units. *Nolte*

**283. Digital Communication Systems.** Digital modulation techniques. Coding theory. Transmission over bandwidth constrained channels. Signal fading and multipath effects. Spread spectrum. Optical transmission techniques. Prerequisite: Electrical Engineering 281 or consent of instructor. 3 units. *Bottomley*

**285. Signal Detection and Extraction Theory.** Introduction to signal detection and information extraction theory from a statistical decision theory viewpoint. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, estimation of parameters and adaptive recursive digital filtering, and decision processes with finite memory. Applications to problems in communication theory. Prerequisite: Electrical Engineering 281 or consent of instructor. 3 units. *Nolte*

**286. Digital Processing of Speech Signals.** Detailed treatment of the theory and application of digital speech processing. Modeling of the speech production system and speech signals; speech processing methods; digital techniques applied in speech transmission, speech synthesis, speech recognition, and speaker verification. Acoustic-phonetics, digital speech modeling techniques, LPC analysis methods, speech coding techniques. Application case studies: synthesis, vocoders, DTW (dynamic time warping)/HMM (hidden Markov modeling) recognition methods, speaker verification/identification. Prerequisite: Electrical Engineering 182 or equivalent or consent of instructor. 3 units. *Hansen*

**287. Underwater Communications.** Elements of communication theory and digital signal processing are combined with basic physics and oceanography to offer an overview of underwater communications, with an emphasis on the radar/sonar problem. Beamforming with transducer arrays. Signal design and target resolution; the ambiguity function. The ocean as a communication channel: sound propagation and ambient noise characteristics. Performance analysis of selected communication scenarios and case studies of operational sonar systems. Prerequisite: Electrical Engineering 181 or consent of instructor. 3 units. *Alexandrou*

**288. Image and Array Signal Processing.** Multidimensional digital signal processing with applications to practical problems in image and sensor array processing. Two-dimensional discrete signals and systems, discrete random fields, 2-D sampling theory, 2-D transforms, image enhancement, image filtering and restoration, space-time signals, beamforming, and inverse problems. Prerequisite: Electrical Engineering 282 or consent of instructor. 3 units. *Krolik*

**289. Adaptive Filters.** Adaptive digital signal processing with emphasis on the theory and design of finite-impulse response adaptive filters. Stationary discrete-time stochastic processes, Wiener filter theory, the method of steepest descent, adaptive transverse filters using gradient-vector estimation, analysis of the LMS algorithm, least-squares methods, recursive least squares and least squares lattice adaptive filters. Application examples in noise cancelling, channel equalization, and array processing. Prerequisites: Electrical Engineering 281 and 282 or consent of instructor. 3 units. *Krolik*

**299. Advanced Topics in Electrical Engineering.** Opportunity for study of advanced subjects related to programs within the electrical engineering department tailored to fit the requirements of a small group. Consent of director of undergraduate studies and of supervising instructor required. Variable credit. *Staff*

**312. Electronic Properties of Submicron Solid-State Devices.** Review of quantum mechanics, scattering and transport, Boltzmann transport equation, quantum effects in devices with emphasis on one- and two-dimensional transport, electron-polar phonon interactions, quantum transport. Prerequisite: quantum mechanics. C-L: Physics 333. 3 units. *Stroschio*

**316. Advanced Physics of Semiconductor Devices.** Semiconductor materials: band structure and carrier statistics. Advanced treatments of metal-semiconductor contacts, Schottky barriers, p-n junctions, bipolar transistors (charge-control and Gummel-Poon models), and field-effect transistors (short channel effects, scaling theory, subthreshold conduction, nonuniformly doped substrates, surface and buried-channel devices, hot-electron effects). Device modeling in two dimensions using PISCES. Prerequisite: Electrical Engineering 216. 3 units. *Goodwin-Johansson and Massoud*

**318. Integrated Circuit Fabrication Laboratory.** Introduction to IC fabrication processes. Device layout. Mask design and technology. Wafer cleaning, etching, thermal oxidation, thermal diffusion, lithography, and metallization. Laboratory fabrication and characterization of basic IC elements (p-n junctions, resistors, MOS capacitors, gated diodes, and MOSFETs). Use of four-point probe, ellipsometer, spreading resistance probe, scanning electron microscope, and evaporation system. Testing of basic inverters and gates. Prerequisites: Electrical Engineering 218 and consent of instructor. 3 units. *Massoud*

**352. Advanced Topics in Digital Systems.** A selection of advanced topics from the areas of digital computer architectures and fault-tolerant computer design. Prerequisite: Electrical Engineering 252 or equivalent. C-L: Computer Science 320. 3 units. *Staff*

**361. Advanced VLSI Design.** Theory of advanced VLSI design. Specifications development, methodology, issues, circuit-level trade-offs. Full custom design, standard cell design, gate array design, silicon compilation. Semiconductor technologies and logic families for semi-custom design. Clocking schemes and distribution, race conditions. Design of a variety of circuits (adders, I/O drivers, RAM, FIFO, etc.) Testing of all phases in the life cycle of an integrated circuit. Top-down design and bottom-up implementation. Student projects. Prerequisite: Electrical Engineering 261 or equivalent. C-L: Computer Science 322. 3 units. *Kedem*

**399. Special Readings in Electrical Engineering.** Special individual readings in a specified area of study in electrical engineering. Approval of director of graduate studies required. 1 to 4 units. Variable credit. *Graduate staff*

## **COURSES CURRENTLY UNSCHEDULED**

**311. Quantum Electronics**

**334. Nonlinear Oscillations in Physical Systems**

**342. Optimal Control Theory**

**371. Advanced Electromagnetic Theory**

**373. Selected Topics in Field Theory**

**382. Advanced Topics in Signal Processing**

**383. Applied Information Theory and Statistical Estimation**

## **Mechanical Engineering and Materials Science**

Professor Cocks, *Chair* (142A Engineering); Professor Harman, *Director of Graduate Studies* (145 Engineering); Professors Behringer, Bejan, Dowell, Garg, Gösele, Hochmuth,



Pearsall, Shaughnessy, Shepard, and Tan; Associate Professors Bliss, Eom, Jones, Knight, Needham, and Wright; Assistant Professors Buzzard, Chen, Clark, Hall, Howle, Lozier, Thompson, and Virgin; Research Associate Professor Zhong; Research Assistant Professors Nagchaudhuri, Ping-Beall, and Zhelev; Adjunct Professors Lee and Wu; Adjunct Associate Professors Cherry, Crowson, and Tran-Son-Tay

The department offers programs of study and research leading to the M.S. and Ph.D. degrees in both mechanical engineering and materials science. Within mechanical engineering, the broad areas of concentration include thermal and fluids systems, mechanics and biomechanics, and dynamics, including nonlinear dynamics and control. Within materials science, the areas of concentration include electronic materials, biomaterials, failure analysis, and the determination of material characteristics. The department emphasizes a highly research-oriented Ph.D. degree program. Current research areas available include: cell, membrane, and surface engineering; biorheology; convection; granular flow; diffusion and heat transfer in heterogeneous media; thermal phenomena in micro- and nanostructures; aerelasticity; computational fluid dynamics; chaotic systems; vibrations and acoustics of dynamic systems; sound propagation and absorbing materials; unsteady aerodynamics; thermal design by entropy generation minimization; control systems; robotics; expert systems; bearing design and lubrication; nano-tribology; magnetic levitation; mechanical properties of human stones; positron annihilation spectroscopy; diffusion and kinetics in Si, GaAs, and other electronic materials; semiconductor wafer bonding; computational materials science; and structural and offshore mechanics.

**202. Engineering Thermodynamics.** Axiomatic formulations of the first and second laws. General thermodynamic relationships and properties of real substances. Energy, availability, and second law analysis of energy conversion processes. Reaction and multiphase equilibrium. Power generation. Low temperature refrigeration and the third law of thermodynamics. Thermodynamic design. 3 units. *Bejan*

**207. Transport Phenomena in Biological Systems.** See C-L: Biomedical Engineering 207; also C-L: Civil Engineering 207. 3 units. *Katz or Truskey*

**208. Introduction to Colloid and Surface Science.** This course divides naturally into three sections. The colloid state: classification of colloids and the theoretical frameworks and experimental techniques involved in their characterization. Interfaces: surface tension and free energy; curved interfaces; adhesion, cohesion and wetting; surface activity; catalytic and mechanical properties of solid surfaces. Inter-Surface Forces: the balance of attractive and repulsive forces which operate between colloidal particles and at macroscopic surfaces. Some emphasis on natural and artificial biomembranes. Consent of instructor required. 3 units. *Needham*

**210. Intermediate Dynamics.** Comprehensive treatment of space kinematics, kinetics of particles and rigid bodies, generalized coordinates, and Lagrange's equations. Introduction to nonlinear and random dynamic analysis of flexible, continuous systems and stability. C-L: Civil Engineering 210. 3 units. *Hall or Knight*

**211. Theoretical and Applied Polymer Science.** An advanced course in materials science and engineering dealing specifically with the structure and properties of polymers. Particular attention paid to recent developments in the processing and use of modern plastics and fibers. Product design considered in terms of polymer structures, processing techniques, and properties. C-L: Biomedical Engineering 208. 3 units. *H. Clark*

**212. Electronic Materials.** An advanced course in materials science and engineering dealing with the various materials important for solid-state electronics including semiconductors, ceramics, and polymers. Emphasis on thermodynamic concepts and on



defects in these materials. Materials preparation and modification methods for technological applications. Prerequisite: Engineering 83L. 3 units. *Tan*

**213. Physical Metallurgy.** An advanced materials science course focusing on the relationships between structure and properties in metals and alloys. Conceptual and mathematical models developed and analyzed for crystal structures, elastic and plastic deformation, phase transformations, thermodynamic behavior, and electrical and magnetic properties. Prerequisites: Engineering 83L and Mechanical Engineering 101L. 3 units. *Pearsall*

**214. Corrosion and Corrosion Control.** Environmental aspects of the design and utilization of modern engineering alloys. Theory and mechanisms of corrosion, particularly in seawater and atmospheric environments. Microstructural aspects of diffusion, oxidation, hot corrosion, and stress corrosion. Prerequisite: Engineering 83L. 3 units. *Jones*

**215. Biomedical Materials and Artificial Organs.** Prerequisite: Biomedical Engineering 83L, Chemistry 151L or Engineering 83L or consent of instructor. See C-L: Biomedical Engineering 215. 3 units. *H. Clark or Reichert*

**216. Mechanical Metallurgy.** An advanced materials science course dealing with the response of materials to applied forces. Mechanical fundamentals; stress-strain relationships for elastic behavior; theory of plasticity. Metallurgical fundamentals; plastic deformation, dislocation theory; strengthening mechanisms. Mechanical behavior of polymers. Applications to materials testing. Prerequisites: Engineering 75L and Engineering 083L. 3 units. *Jones*

**217. Fracture of Engineering Materials.** Conventional design concepts and their relationship to the occurrence of fracture. Linear elastic and general yield fracture mechanics. Microscopic plastic deformation and crack propagation. The relationship between macroscopic and microscopic aspects of fracture. Time dependent fracture. Fracture of specific materials. Prerequisites: Engineering 83L and Mechanical Engineering 115L. 3 units. *Jones*

**218. Thermodynamics of Electronic Materials.** Basic thermodynamic concepts applied to solid state materials with emphasis on technologically relevant electronic materials such as silicon and GaAs. Thermodynamic functions, phase diagrams, solubilities and thermal equilibrium concentrations of point defects; nonequilibrium processes and the kinetic phenomena of diffusion, precipitation, and growth. 3 units. *Tan*

**221. Compressible Fluid Flow.** Basic concepts of the flow of gases from the subsonic to the hypersonic regime. One-dimensional wave motion, the acoustic equations, and waves of finite amplitude. Effects of area change, friction, heat transfer, and shock on one-dimensional flow. Moving and oblique shock waves and Prandtl-Meyer expansion. 3 units. *Shaughnessy*

**225. Mechanics of Viscous Fluids.** Equations of motion for a viscous fluid, general properties and selected solutions of the Navier-Stokes equations, the Stokes equations, laminar boundary layer equations with selected solutions and approximation techniques, origin of turbulence. 3 units. *Hochmuth*

**226. Intermediate Fluid Mechanics.** A survey of the principal concepts and equations of fluid mechanics, fluid statics, surface tension, the Eulerian and Lagrangian description, kinematics, Reynolds transport theorem, the differential and integral equations of motion, constitutive equations for a Newtonian fluid, the Navier-Stokes equations, and boundary conditions on velocity and stress at material interfaces. 3 units. *Shaughnessy or Thompson*

**227. Advanced Fluid Mechanics.** Flow of a uniform incompressible viscous fluid. Exact solutions to the Navier-Stokes equation. Similarity methods. Irrotational flow theory and its applications. Elements of boundary layer theory. Prerequisite: Mechanical Engineering 226 or consent of instructor. 3 units. *Shaughnessy*

**228. Lubrication.** Derivation and application of the basic governing equations for lubrication; the Reynolds equation and energy equation for thin films. Analytical and computational solutions to the governing equations. Analysis and design of hydrostatic and hydrodynamic slider bearings and journal bearings. Introduction to the effects of fluid inertia and compressibility. Dynamic characteristics of a fluid film and effects of bearing design on dynamics of machinery. Prerequisites: Mathematics 111 and Mechanical Engineering 126L. 3 units. *Knight*

**229. Computational Fluid Mechanics and Heat Transfer.** An exposition of numerical techniques commonly used for the solution of partial differential equations encountered in engineering physics. Finite-difference schemes (which are well-suited for fluid mechanics problems); notions of accuracy, conservation, consistency, stability, and convergence. Recent applications of weighted residuals methods (Galerkin), finite-element methods, and grid generation techniques. Through specific examples, the student is guided to construct and assess the performance of the numerical scheme selected for the particular type of transport equation (parabolic, elliptic, or hyperbolic). 3 units. *Howle*

**230. Modern Control and Dynamic Systems.** Dynamic modeling of complex linear and nonlinear physical systems involving the storage and transfer of matter and energy. Unified treatment of active and passive mechanical, electrical, and fluid systems. State-space formulation of physical systems. Time and frequency-domain representation. Controllability and observability concepts. System response using analytical and computational techniques. Lyapunov method for system stability. Modification of system characteristics using feedback control and compensation. Emphasis on application of techniques to physical systems. 3 units. *Garg or Nagchaudhuri*

**231. Adaptive Structures: Dynamics and Control.** Integration of structural dynamics, linear systems theory, signal processing, transduction device dynamics, and control theory for modeling and design of adaptive structures. Classical and modern control approaches applied to reverberant plants. Fundamentals of adaptive feedforward control and its integration with feedback control. Presentation of a methodical design approach to adaptive systems and structures with emphasis on the physics of the system. Numerous MATLAB examples provided with course material as well as classroom and laboratory demonstrations. 3 units. *Clark*

**232. Optimal Control.** Prerequisite: Electrical Engineering 141 or equivalent. See C-L: Electrical Engineering 246. 3 units. *Rindas*

**235. Advanced Mechanical Vibrations.** Analytical and experimental procedures applied to the design of machines and systems for adequate vibration control. Determination of eigenvalues and eigenvectors by iteration and computer techniques, transfer matrices applied to lumped and distributed systems, analytical and numerical methods of obtaining the pulse response of plane and three-dimensional multimass systems, convolution and data processing, introduction to random vibration. 3 units. *Knight or Wright*

**236. Engineering Acoustics.** Fundamentals of acoustics including sound generation, propagation, reflection, absorption, and scattering. Emphasis on basic principles and analytical methods in the description of wave motion and the characterization of sound fields. Applications including topics from noise control, sound reproduction, architectural acoustics, and aerodynamic noise. Occasional classroom or laboratory



demonstration. Prerequisites: Engineering 123L and Mathematics 111 or consent of instructor. 3 units. *Bliss*

**237. Aerodynamics.** Fundamentals of aerodynamics applied to wings and bodies in subsonic and supersonic flow. Basic principles of fluid mechanics and analytical methods for aerodynamic analysis. Two- and three-dimensional wing theory, slender-body theory, lifting surface methods, vortex and wave drag. Brief introduction to vehicle design, performance, and dynamics. Special topics such as unsteady aerodynamics, vortex wake behavior, and propeller and rotor aerodynamics. 3 units. *Bliss*

**238. Advanced Aerodynamics.** Advanced topics in aerodynamics. Conformal transformation techniques. Three-dimensional wing theory, optimal span loading for planar and nonplanar wings. Ground effect and tunnel corrections. Propeller theory. Slender wing theory and slender body theory, transonic and supersonic area rules for minimization of wave drag. Numerical methods in aerodynamics including source panel and vortex lattice methods. Prerequisite: Mechanical Engineering 237. 3 units. *Hall*

**239. Unsteady Aerodynamics.** Analytical and numerical methods for computing the unsteady aerodynamic behavior of airfoils and wings. Small disturbance approximation to the full potential equation. Unsteady vortex dynamics. Kelvin impulse and apparent mass concepts applied to unsteady flows. Two-dimensional unsteady thin airfoil theory. Time domain and frequency domain analyses of unsteady flows. Three-dimensional unsteady wing theory. Introduction to unsteady aerodynamic behavior of turbomachinery. Prerequisite: Mechanical Engineering 237. 3 units. *Hall*

**240. Patent Technology and Law.** The use of patents as a technological data base is emphasized including information retrieval in selected engineering disciplines. Fundamentals of patent law and patent office procedures. Consent of instructor required. 3 units. *Cocks*

**245. Applications in Expert Systems.** A comprehensive introduction to the key practical principles, techniques, and tools being used to implement knowledge-based systems. The classic MYCIN system studied in detail to provide historic perspective. Current systems employing combinations of production rules, prototypical knowledge, and frame-based case studies. Student term projects consist of the development of individual, unique expert systems using the Texas Instruments Personal Consultant. Knowledge of LISP not a prerequisite. 3 units. *Wright*

**252. Buckling of Engineering Structures.** Prerequisite: Civil Engineering 131L or consent of instructor. See C-L: Civil Engineering 252. 3 units. *Virgin*

**265. Advanced Topics in Mechanical Engineering.** Opportunity for study of advanced subjects related to programs within mechanical engineering tailored to fit the requirements of a small group. Approval of director of undergraduate or graduate studies required. Variable credit. *Staff*

**268. Cellular and Biosurface Engineering.** A combination of fundamental concepts in materials science, colloids, and interfaces that form a basis for characterizing: the physical properties of biopolymers, microparticles, artificial membranes, biological membranes, and cells; and the interactions of these materials at biofluid interfaces. Definition of the subject as a coherent discipline and application of its fundamental concepts to biology, medicine, and biotechnology. Prerequisite: Mechanical Engineering 208 or consent of instructor. 3 units. *Needham*

**270. Robot Control and Automation.** Review of kinematics and dynamics of robotic devices; mechanical considerations in design of automated systems and processes, hydraulic and pneumatic control of components and circuits; stability analysis of robots



involving nonlinearities; robotic sensors and interfacing; flexible manufacturing; man-machine interaction and safety consideration. Prerequisites: Mechanical Engineering 230 or equivalent and consent of instructor. 3 units. *Garg*

**275. Product Safety and Design.** An advanced engineering design course that develops approaches to assessing and improving the safety of products and product systems. Safety is presented in terms of acceptable risk and analyzed through legal case studies. Probabilistic decision making; risk economics; risk analysis and assessment. Corequisite: Mechanical Engineering 160L. 3 units. *Pearsall*

**277. Optimization Methods for Mechanical Design.** Definition of optimal design. Methodology of constructing quantitative mathematical models. Nonlinear programming methods for finding "best" combination of design variables: minimizing steps, gradient methods, flexible tolerance techniques for unconstrained and constrained problems. Emphasis on computer applications and term projects. Consent of instructor required. 3 units. *Wright*

**280. Convective Heat Transfer.** Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Use of the principle of similarity and analogy in the solution of turbulent flow heat transfer. Two-phase flow, nucleation, boiling, and condensation heat and mass transfer. 3 units. *Bejan*

**281. Conduction and Radiation.** Conduction heat transfer in the steady and transient state, in rectangular, cylindrical, and spherical coordinates. Melting and solidification. Radiation exchange involving absorbing and emitting media including gases and flames, combined conduction and radiation, and combined convection and radiation. Exact and approximate methods of solution including separation of variables, transform calculus, numerical procedures, and integral and variational methods. 3 units. *Bejan*

**290. Physical Oceanography.** Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Corequisite: Geology 250. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Environment 290 and Geology 203. 3 units. *Lozier*

**325. Aeroelasticity.** A study of the statics and dynamics of fluid/structural interaction. Topics covered include static aeroelasticity (divergence, control surface reversal), dynamic aeroelasticity (flutter, gust response), unsteady aerodynamics (subsonic, supersonic, and transonic flow), and a review of the recent literature including nonlinear effects such as chaotic oscillations. Prerequisites: Mathematics 230 and consent of instructor. 3 units. *Dowell*

**331. Nonlinear Control Systems.** Analytical, computational, and graphical techniques for solution of nonlinear systems; Krylov and Bogoliubov asymptotic method; describing function techniques for analysis and design; Liapounov functions and Lure's methods for stability analysis; Aizerman and Kalman conjectures; Popov, circle, and other frequency-domain stability criteria for analysis and synthesis. Prerequisite: Mechanical Engineering 230 or consent of instructor. 3 units. *Garg or Wright*

**335. Nonlinear Mechanical Vibration.** A comprehensive treatment of the role of nonlinearities in engineering dynamics and vibration. Analytical, numerical, and experimental techniques are developed within a geometrical framework. Prerequisite: Mechanical Engineering 210 or 235 or equivalent. 3 units. *Virgin*

**399. Special Readings in Mechanical Engineering.** Individual readings in advanced study and research areas of mechanical engineering. Approval of director of graduate studies required. 1 to 3 units. Variable credit. *Staff*

## **COURSES CURRENTLY UNSCHEDULED**

**224. An Introduction to Turbulence**

**322. Mechanics of Viscous Fluids**

## **English**

Professor Jackson, *Chair* (312 Allen); Professor Moses, *Director of Graduate Studies* (316 Allen); Professors Aers, Applewhite, Butters, Clum, C. Davidson, DeNeef, Fish, Gleckner, Holloway, F. Lentricchia, Price, Randall, Ryals, Sedgwick, B. H. Smith, Strandberg, Tompkins, Torgovnick, and Williams; Professor of the Practice Gopen; Associate Professors Gaines, Gerber, Jones, Mellown, Moon, Pope, Porter, Schwartz, and Willis; Assistant Professors Chandler, Clarke, Ferraro, Moses, Pfau, Tetel, and Thorn; Assistant Professors of the Practice Cox, Hillard, and Malouf; Adjunct Professor A. E. Davidson; Visiting Professor O. Valbuena

The department offers graduate work leading to the A.M. and Ph.D. degrees, although normally only students seeking the doctorate are admitted to the department. The A.M. degree, if not already earned elsewhere, may be taken by students en route to the Ph.D. (although it is not required) and by those who elect to leave the doctoral program. A statement of the requirements for the A.M. and Ph.D. degrees may be obtained from the director of graduate studies. The department requires a reading knowledge of at least one foreign language for the Ph.D. degree, the specific language (or languages) to be determined by the student's major areas of academic concentration.

Applicants to the program in English should also furnish a copy (not returnable) of a term paper or other essay in nonfiction prose submitted in fulfillment of a requirement in an academic course.

### **For Seniors and Graduates**

**202S. Narrative Writing.** The writing of short stories, memoirs, tales, and other narrations. Readings from ancient and modern narrative. Close discussion of frequent submissions by class members. Consent of instructor required. 3 units. *Porter or Price*

**203S. Advanced Narrative Writing.** The writing of extended narrative prose—long stories, novellas, substantive memoirs. Students should be proficient in the writing of short narratives. Consent of instructor required. 3 units. *Porter or Price*

**205. Semiotics and Linguistics.** See C-L: Russian 205. 3 units. *Andrews*

**208. History of the English Language.** Introductory survey of the changes in sounds, forms, and vocabulary of the English language from its beginning to the present, with emphasis on the evolution of the language as a medium of literary expression. Not open to students who have taken English 112. C-L: Medieval and Renaissance Studies. 3 units. *Butters or Tetel*

**212. Middle English Literature: 1100 to 1500.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Aers*

**213, 214. Chaucer.** 213: first two-thirds of his career, especially *Troilus and Criseyde*. 214: *The Canterbury Tales*. C-L: Medieval and Renaissance Studies. 3 units each. *Aers*

**220. Shakespeare: Selected Topics.** 3 units. *Porter or Valbuena*



**221. Renaissance Prose and Poetry: 1500 to 1660.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, Randall, or Schwartz*

**222. Reading Milton.** Milton's epic as a way of exploring some of the questions that have recently been asked about the humanities in general and literary studies in particular. Is the reconstruction of a perspective within which older texts can be responsibly read possible? What do you have to "know" in order to read *Paradise Lost*? What do you have to know in order to know what you have to know to read *Paradise Lost*? Obviously, *Paradise Lost* will be the center of the course, but we shall also read others of Milton's works and look into the tight little world of Milton criticism. 3 units. *Fish*

**225. Renaissance Drama: 1500 to 1642.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Randall*

**235. Restoration and Eighteenth-Century Literature: 1660 to 1800.** Selected topics. 3 units. *Jackson or Thorn*

**241. Romantic Literature: 1790 to 1830.** Selected topics. 3 units. *Applewhite, Gleckner, Jackson, or Pfau*

**245. Victorian Literature: 1830 to 1900.** Selected topics. 3 units. *Ryals or Sedgwick*

**251. British Literature since 1900.** Selected topics. 3 units. *Lentricchia, Mellown, Moses, or Torgoornick*

**263. American Literature to 1865.** Selected topics. 3 units. *C. Davidson, Jones, Moon, or Tompkins*

**267. American Literature: 1865 to 1915.** Selected topics. 3 units. *C. Davidson, Tompkins, or K. Williams*

**269. American Women Writers.** Selected topics. C-L: Women's Studies. 3 units. *C. Davidson, Pope, or Tompkins*

**275. American Literature since 1915.** Selected topics. 3 units. *Ferraro, Lentricchia, Pope, or Strandberg*

**281. Studies in Genre.** History, criticism, and theory of literary genres such as the novel, pastoral, epic, and drama. 3 units. *Staff*

**284. Contemporary Film Theory.** Post-1968 film theory—Brechtian aesthetics, cinema semiotics, psychoanalytic film theory, technology, feminist theory, and Third World cinema. 3 units. *Gaines*

**285. Major Texts in the History of Literary Criticism.** A survey of major critical writings from Aristotle to the present. 3 units. *Staff*

**288. Special Topics.** Subjects, areas, or themes that cut across historical eras, several national literatures, or genres. 3 units. *Staff*

**289. The Theory of the Novel.** Major issues in the history and theory of the novel. 3 units. *Moses or Torgoornick*

**290. Methods of Composition Pedagogy.** A philosophical and practical exploration of developments in the field of composition studies. Cognition, concept formation, psycholinguistics, interpretation, and the making of meaning. Works by Burke, Richards, Kitzhaber, Berlin, Berthoff, Bizzell, Elbow, Corbett, Macrorie, Williams, Coles, and others. 3 units. *Gopen or Hillard*



## For Graduates

- 312. Studies in Middle English Literature.** C-L: Medieval and Renaissance Studies. 3 units. *Aers*
- 315. Studies in Chaucer.** C-L: Medieval and Renaissance Studies. 3 units. *Aers*
- 321. Studies in Renaissance Literature.** C-L: Medieval and Renaissance Studies and Women's Studies. 3 units. *DeNeef, Fish, Porter, Randall, Schwartz, or Valbuena*
- 324. Studies in Shakespeare.** C-L: Medieval and Renaissance Studies. 3 units. *Porter or Valbuena*
- 329. Studies in Milton.** C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, or Schwartz*
- 337. Studies in Augustanism.** 3 units. *Jackson or Thorn*
- 338. Studies in a Major Augustan Author.** 3 units. *Jackson or Thorn*
- 341. Studies in Romanticism.** 3 units. *Applewhite, Gleckner, Jackson, or Pfau*
- 347. Studies in Victorianism.** 3 units. *Ryals or Sedgwick*
- 348. Studies in a Major Nineteenth-Century British Author.** 3 units. *Gleckner, Jackson, Pfau, Ryals, or Sedgwick*
- 353. Studies in Modern British Literature.** 3 units. *Mellown, Moses, or Torgovnick*
- 361. Studies in American Literature before 1915.** 3 units. *Chandler, Clarke, Holloway, Jones, Moon, Tompkins, or K. Williams*
- 368. Studies in a Major American Author before 1915.** 3 units. *Chandler, Clarke, C. Davidson, Holloway, Jones, Moon, Tompkins, or K. Williams*
- 375. Studies in Modern American Literature.** 3 units. *Applewhite, Chandler, Clarke, Ferraro, Holloway, Lentricchia, or Strandberg*
- 376. Studies in a Modern Author (British or American).** 3 units. *Graduate faculty*
- 381. Special Topics Seminar.** 3 units. *Chandler or Ferraro*
- 385. Studies in Literary Criticism.** 3 units. *Graduate faculty*
- 386. Problems in the Theory of Value and Judgment.** See C-L: Literature 300; also C-L: Philosophy 300. 3 units. *B. H. Smith*
- 388. The History of Rhetoric: Classical to Renaissance.** The foundations of rhetorical studies from Plato, Aristotle, Cicero, and Quintilian through Longinus, Augustine, and Erasmus to Bacon and Ramus. No prerequisites. 3 units. *Gopen or Hillard*
- 389. The History of Rhetoric: Eighteenth to Twentieth Centuries.** Continuing study of the major texts in the history of rhetoric with special attention paid to J. Q. Adams, Campbell, Blair, Whately, Bain, Perelman, and Burke. Prerequisite: English 388. 3 units. *Gopen or Hillard*
- 390. Composition Theory and Pedagogy.** Methodologies of teaching composition, with special emphasis on the theories of structural stylistics employed in the University Writing Program (UWP). All students registering in the course must hold a tutorship in the UWP, must attend the UWP training seminar and all scheduled UWP staff meetings, and will be observed teaching by a UWP director. Ungraded. 3 units. *Gopen or Hillard*
- 391. Tutorial in Special Topics.** Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units. *Staff*

**392. Tutorial in Journal Editing.** Systematic exposure to all phases of academic journal editing. Restricted to holders of journal editing internships. Ungraded. Variable credit. *Staff*

## **COURSES CURRENTLY UNSCHEDULED**

**207A. Introduction to Old English**

**207B. Old English Literature**

**209. Present-Day English**

**283S. Feminist Theory and the Humanities**

**310. Studies in Old English Literature**

**383. Studies in Textual Criticism**

**393. Professionalism, Theory, and Power in Legal and Literary Studies**

## **TUTORIALS**

Tutorials in specialized subjects of study not available in the courses listed above may be offered to single students or to small groups. Instruction normally will be conducted in weekly sessions, or more frequently if the instructor wishes. Emphasis will be on independent reading and investigation, and on oral and written reports. A substantial amount of writing will be required.

Permission of the instructor and the director of graduate studies is required.

## **Environment**

Professor Christensen, *Chair*, Professor Reckhow, *Director of Graduate Studies* (A317A Levine Science Research Center); Professors Barber, C. Bonaventura, J. Bonaventura, Forward, Healy, Knoerr, Orbach, Pilkey, Ramus, Richardson, Schlesinger, V. K. Smith, Terborgh, and Vesilind; Associate Professors Di Giulio, Kirby-Smith, R. Kramer, Maguire, Oren, Richter, Rittschof, Sigmon, van Schaik, Wiener, and Wolpert; Assistant Professors Faust, Freedman, Howd, Katul, Lozier, Mansfield, Rojstaczer, and Urban; Professors Emeriti Anderson, Bookhout, Costlow, Dutrow, Jayne, P. Kramer, Osborne, Stambaugh, and Yoho; Adjunct Professors Adams, Boyce, Cabbage, Dieter, Heath, Sharma, Sizemore, and Steen; Adjunct Associate Professor Tulis; Adjunct Assistant Professors Holmes, Vandenberg, and Wear

Major and minor work is offered in the areas of natural resource and environmental science/ecology, systems science, and economics/policy. Programs of study and research lead to the A.M., M.S., and Ph.D. degrees. College graduates who have a bachelor's degree in one of the natural or social sciences, forestry, engineering, business, or environmental science will be considered for admission to a degree program. Students will be restricted to the particular fields of specialization for which they are qualified academically. Graduate School programs usually concentrate on some area of natural resource and environmental science/ecology, systems science, or economics/policy, while study in resource and environmental management is more commonly followed in one of the professional master's degree programs of the School of the Environment. For more complete program descriptions and information on professional training in forestry or environmental studies, the *Bulletin of Duke University: School of the Environment* should be consulted.

The specific degrees available in natural resources and the environment through the Graduate School are: the A.M. (with or without a thesis), M.S. (with a thesis), and the Ph.D. Students may be required to demonstrate satisfactory knowledge of one or



two foreign languages for the Ph.D. degree. More information on degree and language requirements can be found in the registration and regulations section of this bulletin.

**200. Integrated Case Studies.** A group of two to four students may plan and conduct integrated research projects on a special topic, not normally covered by courses or seminars. A request to establish such a project should be addressed to the case studies director with an outline of the objectives and methods of study and a plan for presentation of the results to the school. Each participant's adviser will designate the units to be earned (up to six units) and evaluate and grade the work. Variable credit. *Staff*

**201. Forest Resources Field Skills.** Introduction to field techniques commonly used to quantify and sample forest resources: trees, soils, water, and animal resources. Dendrology, vegetation sampling, soil mapping, river flow estimation, field water quality sampling, surveying, and use of compass. 2 units. *Davison and Richter*

**204. Forest Inventory, Growth, and Yield.** Measurement of land and forests for purposes of management, appraisal, purchase, and sale. Techniques for predicting the growth and future yield of stands by various methods. 3 units. *Davison*

**205. Ecological Management of Forest Systems (Silviculture).** The aim of the course is to equip future resource managers and environmental consultants with knowledge allowing them to propose lower impact practices to individuals and organizations who need to balance wood production with maintenance of environmental quality. Underlying principles of growth, from seed to mature trees, and stand dynamics are explored. Various alternative methods of manipulating growth, stand structure and development, ranging from little to large perturbations of forest systems, are presented and assessed in terms of their effect on resource quality. 3 units. *Oren*

**205L. Ecological Management of Forest Systems (Silviculture).** Same as 205 with laboratory. 4 units. *Oren*

**207. Forest Pest Management.** Fundamentals of entomology and plant pathology as appropriate to understanding the impacts of insects and diseases on forest productivity and their assessment for integration into forest management. Regional case examples and complexes are evaluated in terms of pest-population, forest-stand dynamics; economic and societal constraints; treatment strategies; monitoring systems; and benefit-cost analysis. This approach seeks to develop predictive capabilities in long-range pest management and decision making. 3 units. *Stambaugh*

**207L. Forest Pest Management.** Same as 207 with laboratory which is largely field oriented to focus on diagnostics and impact analysis. 4 units. *Stambaugh*

**211. Applied Ecology and Ecosystem Management.** An application of ecological principles to applied resource and environmental problems with an emphasis on the ecosystem as a basic working unit. Perspectives include such topics as land/water interactions, the patchiness concept, succession, energy flow, productivity, mineral cycling, perturbation effects on ecosystems, and limiting factors. Prerequisites: introductory courses in biology and ecology. 3 units. *Richardson*

**212. Environmental Toxicology.** Study of environmental contaminants from a broad perspective encompassing biochemical, ecological, and toxicological principles and methodologies. Discussion of sources, environmental transport and transformation phenomena, accumulation in biota and ecosystems. Impacts at various levels of organization, particularly biochemical and physiological effects. Prerequisites: organic chemistry and vertebrate physiology or consent of instructor. 3 units. *Di Giulio*

**213. Forest Ecosystems.** Emphasis on the processes by which forests circulate, transform, and accumulate energy and materials through interactions of biologic organ-



isms and the forest environment. Ecosystem productivity and cycling of carbon, water, and nutrients provide the basis for lecture and laboratory. 3 units. *Richter*

**214. Landscape Ecology.** Emphasis on the role of spatial heterogeneity in terrestrial systems: its detection and description, agents of pattern formation, landscape dynamics and models, and the implications of heterogeneity of populations, communities, and ecosystems. Prerequisites: equivalents of Environment 211, 251, and 351, or consent of instructor. 3 units. *Urban*

**215. Environmental Physiology.** Examination of the concepts of tolerance, limiting factors, bioenergetics, nutrition, stress physiology, homeostasis, and alleopathy for both plant and animal life. Discussion of procedures for and examples of monitoring physiological perturbations due to resource manipulation. 3 units. *Di Giulio and Oren*

**216. Applied Population Ecology.** Population dynamics of managed and unmanaged populations. A quantitative approach to exploitation and conservation of animal and plant populations, including harvesting, population viability analysis, population genetics. Prerequisites: introductory statistics, calculus, and computer programming or consent of instructor. 3 units. *Maguire*

**217. Tropical Ecology.** Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Botany 215 and Zoology 215. 3 units. *Terborgh*

**218L. Barrier Island Ecology.** An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Strong emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Botany 218L and Marine Sciences. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

**219L. Marine Ecology.** Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. Four units (fall and spring); six units (summer). (Given at Beaufort.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Marine Sciences and Zoology 203L. Variable credit. *Kirby-Smith*

**220. Vegetation Management in Urban Ecosystems (Urban Forestry).** Biology and management of woody vegetation, especially trees, across the urban-forest continuum. Special uses and problems of the urban forest are discussed in terms of socioeconomic, legal, arboricultural, and environmental considerations. Management case studies and field trips will be used to gain insights into tree valuation, inventory, and municipal ordinances and administration. 3 units. *Stambaugh*

**221. Soil Resources.** Emphasis on soil resources as central components of terrestrial ecosystems, as rooting environments for plants, and as porous media for water. Soil physics and chemistry provide the basis for the special problems examined through the course. Laboratory emphasizes field and lab skills, interpretive and analytical. 3 units. *Richter*

**222. Physical Processes in Coastal Environments.** The physical processes on beaches, the inner continental shelf, and in estuaries, in the context of their implications for the biological and geological environments. Topics to be drawn from the origin of waves and currents, tides, turbulence and mixing transport of sand and larvae. Applications to biomechanics and coastal erosion, and to marine ecology, coastal zone management, and water quality. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Geology 201 and Marine Sciences. 3 units. *Howd*

**223L. Behavioral Ecology.** How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Not open to undergraduates. (Given at Beaufort.) Prerequisites: introductory biology (Biology 21L and 22L). C-L: Marine Sciences. 6 units. *Rubenstein (visiting summer faculty)*

**225L. Coastal Ecotoxicology and Pollution.** Principles of transport, fates, food-web dynamics and biological effects of pollutants in the marine environment. Laboratory to stress standard techniques for assessing pollutant levels and effects. (Given at Beaufort.) Prerequisites: introductory chemistry and biology. C-L: Marine Sciences. 4 units. *Kenney*

**226L. Marine Mammals.** Ecology, social organization, behavior, acoustic communication, and management issues. Focused on marine mammals in the southeastern United States (for example, bottlenose dolphin, right whale, West Indian manatee). Laboratory exercises will consider social organization and acoustic communication in the local bottlenose dolphin population. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Marine Sciences. 4 units. *Staff*

**228L. Physiology of Marine Animals.** Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Not open to undergraduates. Four units (fall); six units (summer). (Given at Beaufort.) Prerequisites: introductory biology and chemistry. C-L: Marine Sciences. Variable credit. *Forward*

**229L. Biochemistry of Marine Animals.** Functional, structural, and evolutionary relationships of biochemical processes of importance to marine organisms. Not open to undergraduates. (Given at Beaufort.) Prerequisites: introductory biology and inorganic chemistry. C-L: Marine Sciences. 4 units. *Rittschof*

**230L. Weather and Climate.** Overview of the science of meteorology and principles of climatology, especially as applied to problems in ecology and natural resource management. Emphasis on the processes and characteristics of weather phenomena and local and regional climates. General introduction to sources of climatic data and climatic data analysis. Includes laboratory. 4 units. *Knoerr*

**232. Microclimatology.** Introduction to the micrometeorological processes. Discussion of the integration of these processes and the resulting microclimates in the rural (forest, field, and water surface) and urban environments. Methods for modification of the microclimate. Offered on demand. C-L: Botany 232. 3 units. *Knoerr*

**234L. Watershed Hydrology.** Introduction to the hydrologic cycle with emphasis on the influence of land use, vegetation, soil types, climate, and land forms on water quantity and quality and methods for control. Development of water balance models. Analysis of precipitation patterns, rainfall and runoff, and nonpoint source impacts. Statistical handling and preparation of hydrologic data, simulation and prediction models, introduction to groundwater flow, laboratory and field sampling methods. 4 units. *Katul*

**235. Air Quality Management.** Types, sources, effects of air pollutants. Regulatory framework emphasizing the Clean Air Act Amendments of 1990 and federal, state, local agency implementation. Application of risk assessment, technology, market incentives



to air management. Scientific, policy aspects of acid deposition, global climate change, indoor air, mobile sources control. Dispersion modeling, exposure assessment. 3 units. *Vandenberg*

**236. Water Quality Management.** Types, sources, and effects of pollutants. Water quality standards and criteria. Engineering approaches to water management. Mathematical models and their application to water quality management. Federal regulations, in particular, the Federal Water Pollution Control Act and the Safe Drinking Water Act. Policy analysis for water quality management planning. 3 units. *Reckhow*

**240. Fate of Organic Chemicals in the Aquatic Environment.** Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in surface and groundwaters and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatography and mass spectrometry. Prerequisites: university-level general chemistry and organic chemistry within last four years. C-L: Civil Engineering 240. 3 units. *Dubay and Faust*

**241. Atmospheric Chemistry and Air Pollution.** Chemical kinetics and equilibrium applied to the mechanistic and quantitative description of processes affecting the fates of anthropogenic and natural chemicals in the troposphere, on local, regional, and global scales. Direct photolysis; gas-phase photo-formation and fates of ozone, radicals, and other oxidants; gas-phase oxidations of volatile organic compounds; gas-to-drop partitioning; aqueous-phase photoformation and fates of hydrogen peroxide, radicals, and other oxidants in the aqueous phases of clouds, fogs, and aerosols; effects of aqueous-phase reactions on the chemical composition of the troposphere; gas-phase and aqueous-phase oxidations of organic and inorganic compounds; stratospheric ozone depletion. Prerequisites: university-level general chemistry and organic chemistry within last four years. C-L: Civil Engineering 241. 3 units. *Faust*

**242. Environmental Aquatic Chemistry.** Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, adsorption, and heterogeneous reactions. Prerequisite: university-level general chemistry within last four years. C-L: Civil Engineering 242. 3 units. *Faust*

**243. Environmental Biochemistry.** Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Cell Biology 243 and Marine Sciences. 3 units. *C. Bonaventura*

**244L. Cellular and Molecular Research Techniques.** Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium, assays, rapid reaction kinetics, microscopy, molecular graphics, and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. Includes laboratory. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Cell Biology 244L and Marine Sciences. 4 units. *C. Bonaventura and Brouwer*



**245. Ecology of Microorganisms.** Factors affecting the abundance, distribution, and behavior of microorganisms. Topics include microbial form and function, activities in the environment, and applications to current environmental issues. 3 units. *Staff*

**246. Survey of Occupational Health and Safety.** Occupational risks associated with biological, chemical, ergonomic, radiation, and toxic hazards. The nature and scope of occupational hazards, health effects, and risk assessment and management strategies. Open to undergraduates by consent. 3 units. *Staff*

**247. Survey of Environmental Health and Safety.** Environmental risks from the perspective of global ecology, biology, chemistry, and radiation. The nature and scope of environmental hazards, environmental impacts and health effects, and risk assessment and management strategies. Open to undergraduates by consent. 3 units. *Staff*

**248. Solid Waste Engineering.** Engineering design of material and energy recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Application of systems analysis to collection of municipal refuse. Major design project in solid waste management. Prerequisite: Civil Engineering 124L or consent of instructor. C-L: Civil Engineering 248. 3 units. *Vesilind*

**251. Statistics and Data Analysis in Biological Science.** Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on biological science applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Statistics 210B. 3 units. *Staff*

**252L. Statistics and Data Analysis in Earth and Ocean Science.** Techniques commonly used by earth and ocean scientists for the analysis of spatial and/or temporal series of data. Topics include regression, Fourier analysis, nonparametric spectral analysis, and, perhaps, principal components analysis and parametric spectral estimators. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32, Statistics 110 or 112, or consent of instructor. C-L: Geology 222L and Marine Sciences. 4 units. *Howd*

**253. Environmental Applications of Biometry.** Overview of statistical methods frequently used for the analysis of experiments in organismal and field biology. Topics include nonparametric statistical methods, analysis of frequencies, probit analysis of dose-response data, and the identification and application of statistical methods for specialized needs. Prerequisite: Environment 251 or equivalent. 3 units. *Gerhart*

**255. Applied Regression Analysis.** Linear regression using both graphical and numerical methods. Model construction, critique, and correction using graphical residual analysis. One-way and two-way analysis of variance; introduction to design of experiments. Use of a standard statistical software package. Applications and examples drawn from various sources, emphasizing the biological and environmental sciences. Prerequisite: Statistics 210B or equivalent. C-L: Statistics 242. 3 units. *Staff*

**256S. Seminar in Ocean Sciences.** Biological, chemical, physical, and geological aspects of the ocean and their relation to environmental issues. Consent of instructor required. (Given at Beaufort.) C-L: Marine Sciences. 2 units. *Staff*

**261. Remote Sensing for Resource Management.** An examination of remote sensing systems as sources of information in resource management with an emphasis on aerial photography and multispectral scanners. Emphasis on the interpretation of airborne and space imagery. 3 units. *Davison*

**262. Forest Utilization Field Trip.** Introduction to utilization in the managed forest and the principal wood-using industries. Taught as a one-week field seminar. May be taken by nonforestry majors. 1 unit. *Staff*

**266. Ecology of Southern Appalachian Forests.** Field trips to various forest ecosystems in the southern Appalachian Mountains. Species identification, major forest types, field sampling, and history of effects of human activities. Consent of instructor required. 1 unit. *Richter*

**268. Advanced Topics in Nearshore Processes.** Advanced treatment of fluid processes in the nearshore. Topics drawn from nonlinear wave theory, radiation stresses and their gradients, forced and free infragravity waves, and the origins of mean currents in the surf zone. Other topics following students' interests. (Given at Beaufort.) Prerequisite: Environment 290, Mathematics 111 or 114, or consent of instructor. C-L: Geology 204 and Marine Sciences. 3 units. *Howd*

**270L. Resource and Environmental Economics.** The application of economic concepts to private- and public-sector decision making concerning natural and environmental resources. Intertemporal resource allocation, benefit-cost analysis, valuation of environmental goods and policy concepts. Includes laboratory. Prerequisite: introductory course in microeconomics. C-L: Economics 270L and Public Policy Studies 272L. 4 units. *Kramer*

**271. Economic Analysis of Resource and Environmental Policies.** Case and applications oriented course examining current environmental and resource policy issues. Benefits and costs of policies related to sustaining resource productivity and maintaining environmental quality will be analyzed using economic and econometric methods. Topics include benefit-cost analysis, intergenerational equity, externalities, public goods, and property rights. Prerequisite: Environment 270L or equivalent; Economics 149 recommended. C-L: Economics 272. 3 units. *Staff*

**272. Evaluation of Public Expenditures.** Basic development of cost benefit analysis from alternative points of view, for example, equity debt, and economy as a whole. Techniques include: construction of cash flows, alternative investment rules, inflation adjustments, optimal timing and duration of projects, private and social pricing. Adjustments for economic distortions, foreign exchange adjustments, risk and income distribution examined in the context of present value rules. Examples and cases from both developed and developing countries. C-L: Economics 261 and Public Policy Studies 261. 3 units. *Conrad*

**273. Marine Fisheries Policy.** Principles, structure, and process of public policy-making for marine fisheries. Topics include local, regional, national, and international approaches to the management of marine fisheries. A social systems approach is used to analyze the biological, ecological, social, and economic aspects of the policy and management process. (Given at Beaufort.) C-L: Marine Sciences. 3 units. *Orbach*

**274. Resource and Environmental Policy.** Development of a policy analysis framework for studying resource and environmental policy. Political institutions, interest group theory, public choice theory, role of economics in policy analysis, ethics and values. Application to current and historical U.S. policy issues. Prerequisite: Environment 270L, Public Policy Studies 272, or consent of instructor. C-L: Public Policy Studies 274. 3 units. *Staff*

**276. Marine Policy.** Formal study of policy and policy-making concerning the coastal marine environment. History of specific marine-related organizations, legislation, and issues and their effects on local, regional, national, and international arenas. Topics explored through use of theoretical and methodological perspectives, including political science, sociology, and economics. Consent of instructor required. (Given at Beaufort.) C-L: Marine Sciences and Public Policy Studies 197. 3 units. *Orbach*

**277. Conservation and Sustainable Development I: Concepts and Methods.** Ag-ronomic, ecological, and economic concepts of sustainability, with emphasis on appli-



cation in developing countries; forest, soil, and wildlife resources; models in conservation biology; historical, cultural, and sociological perspectives; policy analysis. 3 units. *Staff*

**278. Conservation and Sustainable Development II: Integrated Problem Solving.** Approaches to reconciling conservation and development, with emphasis on developing countries. Case studies; project formulation, implementation, and evaluation; institutional policy formation; conflict resolution. 3 units. *Staff*

**282S. Environmental Ethics.** Selected topics involving values and the environment, for example, extending morality to nature, rights of future generations, environmental aesthetics, diversity and stability, ideological biases in ecological knowledge. Consent of instructor required. C-L: Philosophy 289S. 3 units. *Cooper*

**285. Land Use Principles and Policy.** Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. C-L: Public Policy Studies 285. 3 units. *Healy*

**290. Physical Oceanography.** Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Corequisite: Geology 250. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Geology 203 and Mechanical Engineering 290. 3 units. *Lozier*

**291. Geological Oceanography.** The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Geology 205 and Marine Sciences. 3 units. *Staff*

**292. Biological Oceanography.** Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Not open to undergraduates. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Marine Sciences. 3 units. *Ramus or staff*

**292L. Biological Oceanography.** Same as 292 with laboratory. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Marine Sciences. 6 units. *Ramus or staff*

**293. Analysis of Ocean Ecosystems.** The history, utility, and heuristic value of the ecosystem; ocean systems in the context of Odum's ecosystem concept; structure and function of the earth's major ecosystems. Not open to undergraduates. (Given at Beaufort.) Prerequisite: one year of biology, one year of chemistry, or consent of instructor. C-L: Marine Sciences. 3 units. *Barber*

**294L. Marine Communities.** Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. Not open to undergraduates. (Given at Beaufort.) Prerequisites: introductory biology and mathematics. C-L: Marine Sciences. 4 units. *Gerhart*

**295L. Marine Invertebrate Zoology.** Structure, function, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Biology or Zoology 274L. Not open to undergraduates. Four units (fall); six units (summer). (Given at Beaufort.) Prerequisite: introductory biology. C-L: Marine Sciences. Variable credit. *Kirby-Smith*



**297L. Biology of Marine Invertebrates.** Systematic survey of the principal marine invertebrate taxa, with emphasis on structure, function, behavior, and ecology. Field trips and independent projects. Not open to undergraduates who have taken Biology 176L. (Given at Beaufort.) Prerequisites: introductory biology (Biology 21L and 22L). C-L: Marine Sciences and Zoology 274L. 6 units. *Dimock (visiting summer faculty)*

**298. Special Topics.** Content to be determined each semester. Variable credit. *Staff*

**299. Independent Studies and Projects.** Directed readings or research at the graduate level to meet the needs of individual students. Consent of instructor required. Units to be arranged. Variable credit. *Staff*

**302. Models in Forest and Environmental Management.** Students learn how to design and choose models for forestry and ecology. Emphasis on using models to develop strategy and evaluate options for culturing forests and related ecosystems. Subjects include timber, wildlife, water, recreation, and cash flow. 3 units. *Boyce*

**305. Harvesting Effects on Productivity.** Impacts of harvesting on the residual stand, soil properties, water quality, and future site productivity. The integration of harvesting into overall stand management through a full rotation is stressed. Offered on demand. 2 units. *Davison*

**306. Models for Landscape Forestry: Meeting Consumer Demands.** Reduction of complexity of changing states of organization of forested landscapes to explicit managerial plans. Consequences of alternative plans are displayed in relationship to requirements for eco-labels and certification. Easily constructed models are designed for use with computers. Consent of instructor required. Intensive. 1 unit. *Austin and Boyce*

**307. Ecophysiology of Productivity and Stress.** Exploration of principles governing stand growth and its response to a variety of stresses. Emphasis on climate, soil resources, and competition. Stresses and their reliefs determined by pollution and the availability of resources as modifiers of the physiological properties of trees. 3 units. *Oren*

**312. Wetlands Ecology and Management.** The study of bogs, fens, marshes, and swamps. Emphasis on processes within the ecosystem: biogeochemical cycling, decomposition, hydrology, and primary productivity. Ecosystem structure, the response of these systems to perturbations, and management strategies are discussed. A research project is required. Prerequisites: Environment 211 or equivalent and consent of instructor. 3 units. *Richardson*

**313. Advanced Topics in Environmental Toxicology.** Discussion of current issues. Topics vary but may include chemical carcinogenesis in aquatic animals; biomarkers for exposure and sublethal stress in plants and animals; techniques for ecological hazard assessments; and means of determining population, community, and ecosystem level effects. Lectures and discussions led by instructor, guest speakers, and students. Prerequisite: Environment 212. 3 units. *Di Giulio*

**314. Integrated Case Studies in Toxicology.** Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. Offered on demand. C-L: Pharmacology 314. 1 unit. *Abou-Donia and Richardson*

**316. Case Studies in Environmental and Forest Management.** Structured methods for environmental and resource problem solving, including benefit-cost, statistical, and decision analyses, as well as simulation and optimization, are applied to case studies. Previous course work provides a foundation for addressing ecological, economic, ethical, and sociopolitical aspects of management issues. Students work in teams to

develop operational management plans which are presented in oral and written form. Prerequisite: Environment 211, 270, or 213 or equivalent, two quantitative courses, or consent of instructor. 4 units. *Maguire*

**317. Topics in Tropical Ecology and Conservation.** Discussion of current issues and ideas at the interface between basic and applied science. Lectures, seminars, and discussion with student participation. Prerequisite: Environment 217 or equivalent. 2 units. *Terborgh*

**322L. Microbiology of Forest Soils.** Ecology of the microbial populations of forest soils, with emphasis on rhizosphere interactions, root pathogenesis, and mycorrhizae. Includes laboratory. Offered on demand. Prerequisites: consent of instructor; mycology and bacteriology are recommended. 4 units. *Stambaugh*

**330L. Environmental Monitoring and Instrumentation.** Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Includes laboratory. Offered on demand. C-L: Botany 330L. 4 units. *Knoerr*

**333. Basic Groundwater Hydrology.** Basic principles, concepts, and methods of groundwater hydrology. Topics include water storage and transmission characteristics of rocks, physical features of U.S. groundwater regions, problems related to development and protection of the groundwater resource. Intensive. 1 unit. *R. Heath*

**335. Water Quality Modeling.** Development and evaluation of simulation models of surface water quality. Mechanistic descriptions of aquatic ecosystems and materials transport. Statistical methods for monitoring design and trend detection. Uncertainty analysis. Prerequisites: Environment 236 and 350. 2 units. *Reckhow*

**340. Biohazard Science.** Philosophy of safety; etiology, infectivity, and transmissibility of disease; immunity and resistance; occupational and nosocomial infections; aerobiology; biotechnology; disinfection and sterilization; biocontainment and facility design; and safety management. Prerequisite: general microbiology or consent of instructor. 3 units. *Tulis*

**341L. Methods in Biohazard Science.** Fundamentals of disinfection, sterilization, and biocidal materials methodology, inactivation kinetics and dosimetry; medical waste management; mutagenicity, pyrogenicity, and PCR testing; laminar flow cabinet certification; microbiologic surface and air sampling; respirator assessment; laboratory audits and regulatory compliance. Prerequisite: Environment 340 or consent of instructor. 4 units. *Staff*

**342. Bioaerosols.** Principles of aerobiology; sick-building syndrome and building-related illness; ventilation, filtration, and humidification systems; chemical and biological pollutants; health effects; sampling and assessment of bioaerosols; remediation measures; handling indoor air quality perceptions. Consent of instructor required. 2 units. *Thomann and Tulis*

**343. Hazard Management, Law, and Ethics.** Economics and ecology; survey of federal and state laws; legal basis for regulation; enforcement, including inspections and audits, permits and licensing, and citations, injunctions, and penalties; management accountability; ethics in science and medicine; risk assessment and management; policy development and implementation. Consent of instructor required. 3 units. *Warren*

**351. Computer-Based Map Analysis with Geographic Information Systems.** Introduction to computer-based map analysis systems (geographic information systems). Use of map algebra in computer analyses of spatially distributed map information.



Applications in analyzing and solving natural resource management problems. 3 units. *Knoerr*

**355. Optimization Methods for Resource Management.** Introductory survey of optimization techniques useful in resource management and environmental decision making. Numerical techniques for unconstrained optimization, linear programming, dynamic programming, and optimal control methods. Consent of instructor required. 3 units. *Staff*

**356. Environmental Fluid Mechanics.** Introduction to turbulent fluid flow and Navier Stokes equations; basic concepts in statistical fluid mechanics; development of prognostic equations for turbulent fluxes, variances, and turbulent kinetic energy; Monin and Obukhov similarity theory for stratified turbulent boundary layer flows; applications to CO<sub>2</sub>, water vapor, and heat fluxes from uniform and nonuniform surfaces; the local structure of turbulence and Kolmogorov's theory; turbulent energy transfer and energy cascade between scales; turbulence measurements in the natural environment. Prerequisite: Civil Engineering 122L, Mathematics 111 or 135, or equivalent. 3 units. *Katul*

**367. Laird, Norton Distinguished Visitor Series.** Examination of concepts, practices, and policies employed in the management of industrial and public forests; discussion of the problems of large-scale forest management. 1 unit. *Staff*

**372. Advanced Natural Resource Economics.** Methods for evaluating conservation, development, and restoration of renewable and exhaustible environmental resources. Introduction to the role of public goods and externalities in designing policies to sustain resource productivity and maintain environmental quality (developed in more detail in 373). Topics include renewable resources, exhaustible resources, intergenerational equity, property rights, and optimal control. Consent of instructor required. C-L: Economics 372. 3 units. *Staff*

**373. Advanced Environmental Economics.** Examination of the economic measurement of environmental benefits and damages. Consideration of economic concepts for the design of environmental policies. Topics include externality theory, public goods, contingent valuation, and hedonic models. Consent of instructor required. C-L: Economics 373. 3 units. *Kramer*

**385. Decision Theory and Risk Analysis.** Bayesian decision theory, including probability, subjective probability, utility theory, value of sample information, and multiattribute problems. Applications of decision theory in resource and environmental policy-making. Ecological risk assessment, including case studies. Prerequisite: Environment 251 or equivalent. 3 units. *Maguire and Reckhow*

**388. Seminar in Resource and Environmental Policy.** Discussion of the political, legal, and socioeconomic aspects of public and private action in environmental quality control and management. Consent of instructor required. Variable credit. *Staff*

**389. Seminar in Conservation and Environmental History.** Traces the evolution of conservation and environmental movements and the development of environmental ethics. History of agencies, industries, associations, and citizen groups as well as overall policies for land and resources. Comparison of parallel developments in Canada. Consent of instructor required. C-L: History 389. 3 units. *Steen*

**393. Professional Writing.** Techniques in writing grant proposals, technical reports, and environmental impact statements. (Given at Beaufort.) 2 units. *Staff*

**395. Coastal Environmental Speaker Series.** Examination of contemporary issues in coastal environmental management. Guest speakers. (Given at Beaufort.) 1 unit. *Staff*



## COURSES CURRENTLY UNSCHEDULED

**210. Forest Pathology**

**210L. Forest Pathology**

**224S. Molecular and Cellular Adaptations of Marine Organisms**

**254. Advanced Research Training in Marine Molecular Biology and Biotechnology**

**254L. Advanced Research Training in Marine Molecular Biology and Biotechnology**

## Genetics

Professor Webster, *Director* (biochemistry); Professors Antonovics (botany), Bastia (microbiology), Boynton (botany), Counce (cell biology), Cullen (genetics and microbiology), Endow (microbiology), Gillham (zoology), Greenleaf (biochemistry), Hsieh (biochemistry), Joklik (microbiology), Keene (microbiology), Kredich (medicine and biochemistry), Laurie (zoology), Modrich (biochemistry), Nevins (genetics and microbiology), Nicklas (zoology), Raetz (biochemistry), Rausher (zoology), Roses (neurobiology), Shaw (chemistry), Steege (biochemistry), Uyenoyama (zoology), and Webster (biochemistry); Associate Professors Been (biochemistry), Burdett (microbiology), Greene (biochemistry), Kiehart (cell biology), Kohorn (botany), Kreuzer (microbiology), Linney (microbiology), Schachat (cell biology), and Vilgalys (botany); Assistant Professors Davis (genetics and cell biology), Capel (cell biology), Dong (botany), Fehon (zoology), Garcia-Blanco (molecular cancer biology), Garrett (molecular cancer biology), Heitman (genetics and pharmacology), Hershfield (biochemistry), Honma (botany), Horowitz (molecular cancer biology), Kaufman (biochemistry), Lew (cell biology), Lin (cell biology), Marchuk (genetics and cell biology), Markert (immunology), Peterson (genetics), Pickup (microbiology), Seldin (microbiology), Sun (botany), Swenson (molecular cancer biology), Titus (cell biology), and Wharton (genetics and microbiology); Adjunct Professors Drake (National Institute of Environmental Health Sciences), Judd (National Institute of Environmental Health Sciences), Kunkel (National Institute of Environmental Health Sciences), and Resnick (National Institute of Environmental Health Sciences)

The graduate program in genetics provides study and research opportunities in a wide array of experimental systems. The integrated program is administered jointly by the Department of Genetics and the interdepartmental University Program in Genetics, with a faculty drawn from several of the biological sciences departments (biochemistry, botany, cell biology, chemistry, immunology, microbiology, molecular cancer biology, neurobiology, pharmacology, and zoology). Graduate students registered in any of the biological sciences departments may apply to the faculty of the genetics program to pursue study and research leading to an advanced degree. Requests for information describing more completely the research interests of the staff, facilities, and special stipends and fellowships should be addressed to the Director, University Program in Genetics, Box 3565, Duke University Medical Center, Durham, North Carolina 27710.

## GENETICS COURSES (GEN)

**222. Genetic Analysis of Cellular Function.** Classical and molecular genetic approaches to understanding eukaryotic cell function using unicellular organisms such as yeasts and dictyostelium. Experimental approaches as well as illustrative studies of secretion, cell cycle, signal transduction, and cytoskeleton. Discussion of current literature and student presentations. Consent of instructors required. C-L: The University Program in Genetics 222. 3 units. *Davis and Heitman*

**232. Human Genetics.** Topics include segregation, genetic linkage, population genetics, multifactorial inheritance, biochemical genetics, cytogenetics, somatic cell

genetics, neurogenetics, cancer genetics, clinical genetics, positional cloning, complex disease. Lectures plus weekly discussion of assigned papers from the research literature. Prerequisites: University Program in Genetics 278 or equivalent, and graduate status or consent of instructor. C-L: The University Program in Genetics 232. 3 units. *Marchuk, Pericak-Vance, and Speer*

## THE UNIVERSITY PROGRAM IN GENETICS COURSES (UPG)

**215. Genetic Mechanisms.** A comprehensive treatment of molecular and classical genetic mechanisms, emphasizing gene structure and function, genetic analyses in various experimental systems, as well as the behavior of chromosomes in replication, segregation, and recombination. Prerequisite: introductory genetics. C-L: Biochemistry 215. 4 units. *Nevins and staff*

**222. Genetic Analysis of Cellular Function.** Consent of instructors required. See C-L: Genetics 222. 3 units. *Davis and Heitman*

**232. Human Genetics.** Prerequisites: University Program in Genetics 278 or equivalent, and graduate status or consent of instructor. See C-L: Genetics 232. 3 units. *Marchuk, Pericak-Vance, and Speer*

**247. Macromolecular Synthesis.** Consent of instructor required for undergraduates. See C-L: Cell and Molecular Biology 247. 2 units. *Garcia-Blanco and Keene*

**248. Cell Biology.** Consent of instructor required for undergraduates. See C-L: Cell and Molecular Biology 248. 2 units. *Bennett and Sheetz*

**263. Molecular Genetics of *Drosophila* Development.** Consent of instructor required. See C-L: Cell Biology 263; also C-L: Zoology 263. 2 units. *Fehon, Kiehart, and Wharton*

**268. Molecular Biology II: Nucleic Acids.** Prerequisites: introductory biochemistry and equivalents of Biochemistry 259 and Cell and Molecular Biology 247, 277, and 278. See C-L: Biochemistry 268; also C-L: Cell Biology 268, Immunology 268, and Microbiology 268. 4 units. *Steege and staff*

**277. Structure of Macromolecules.** Consent of instructor required for undergraduates. See C-L: Cell and Molecular Biology 277. 2 units. *Beese and White*

**278. Genetic Analysis.** Fundamentals of classical genetics, including Mendelian inheritance, dominance, complementation, epistasis, recombination; overviews of important genetic organisms. Consent of instructor required for undergraduates. Second half of fall semester. C-L: Cell and Molecular Biology 278. 2 units. *Garrett and Steege*

**281. DNA, Chromosomes, and Evolution.** Prerequisite: an introductory course in genetics or cell or molecular biology, or consent of instructor. See C-L: Zoology 281. 3 units. *Laurie and Nicklas*

**283. Molecular Genetics of Organelles.** Prerequisite: introductory genetics. See C-L: Zoology 283; also C-L: Botany 283. 3 units. *Boynton (botany) and Gillham (zoology)*

**286. Evolutionary Mechanisms.** Prerequisites: Biology 21L and 22L, and Biology 180 or equivalents. See C-L: Botany 286; also C-L: Zoology 286. 3 units. *Antonovics, Rausher, and Uyenoyama*

**287. Evolutionary Genetics.** An introduction to the principles of evolutionary genetics, with discussion of the current literature. Levels of selection; neutral theory; variation in populations; speciation. Reconstructing evolutionary history; genomic evolution. 2 units. *Antonovics*



**288. Mathematical Population Genetics.** Prerequisites: calculus; statistics and linear algebra recommended. See C-L: Zoology 288. 3 units. *Uyenoyama*

**316. Genetics Student Research.** Presentations by genetics program students on their current research. Required course for all graduate students specializing in genetics. Credit only. 1 unit. *Endow and Kohorn*

**350. Genetics Colloquium.** Lectures, discussion sections, and seminars on selected topics of current interest in genetics. Required of all students specializing in genetics. Prerequisites: a course in genetics and consent of instructor. 1 unit. *Gillham and staff*

## Geology

Professor Corliss, *Chair* (338 Old Chemistry); Professor Heron, *Director of Graduate Studies* (205 Old Chemistry); Professors Baker, Barber, Haff, Karson, Kay, Livingstone, Perkins, Pilkey, and Schlesinger; Associate Professor Malin; Assistant Professors Boudreau, Howd, Klein, Lozier, and Rojstaczer

The Department of Geology offers graduate work leading to the M.S. and Ph.D. degrees. An undergraduate degree in geology is not a prerequisite for graduate studies. For the M.S. degree a student must have had or must take a summer field geology course (or equivalent experience), mineralogy, igneous and metamorphic rocks, stratigraphy or sedimentation, and structural geology. In addition, the student must have had one year of college chemistry, one year of college physics, and mathematics through calculus. Requirements for the Ph.D. are decided on an individual basis. Graduate courses and research in the Department of Geology provide specialized training in the fields of coastal geology, earth surface processes and geomorphology, facies analysis, geological oceanography and limnology, geophysics, high-temperature geochemistry, hydrogeology, igneous petrology, low-temperature geochemistry, micropaleontology, paleo-oceanography, sedimentary petrology, seismology, and structural geology/tectonics.

### For Seniors and Graduates

**200. Beach and Coastal Processes.** The study of sedimentary processes and geomorphology of nearshore environments with emphasis on both developed and undeveloped barrier island systems. 3 units. *Pilkey*

**201. Physical Processes in Coastal Environments.** The physical processes on beaches, the inner continental shelf, and in estuaries, in the context of their implications for the biological and geological environments. Topics to be drawn from the origin of waves and currents, tides, turbulence and mixing transport of sand and larvae. Applications to biomechanics and coastal erosion, and to marine ecology, coastal zone management, and water quality. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Environment 222 and Marine Sciences. 3 units. *Howd*

**203. Physical Oceanography.** Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Corequisite: Geology 250. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Environment 290 and Mechanical Engineering 290. 3 units. *Lozier*

**204. Advanced Topics in Nearshore Processes.** Advanced treatment of fluid processes in the nearshore. Topics drawn from nonlinear wave theory, radiation stresses and their gradients, forced and free infragravity waves, and the origins of mean currents in the surf zone. Other topics following students' interests. (Given at Beaufort.) Prerequisite: Environment 290, Mathematics 111 or 114, or consent of instructor. C-L: Environment 268 and Marine Sciences. 3 units. *Howd*



**205. Geological Oceanography.** The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Environment 291 and Marine Sciences. 3 units. *Staff*

**206S. Principles of Geological Oceanography.** Geological aspects of the ocean basins including coastal to deep water sediment types and sedimentation processes, sea floor physiography and environmental problems. 3 units. *Pilkey*

**208S. Paleooceanography.** Geology, paleoceanography, and evolution of the oceans, ocean basins, and marine biota based on analysis of deep-sea sedimentary sequences. 3 units. *Corliss*

**214S. Sedimentary Petrography.** Descriptive and interpretive analysis of sediments and sedimentary rocks in thin section, with an emphasis on diagenesis. Consent of instructor required. 3 units. *Perkins*

**215. Clastics Facies Analysis: Recent and Ancient.** Modern clastic depositional systems and their ancient analogs. Prerequisite: Geology 110L. 3 units. *Heron*

**216. Field Analysis of South Florida Carbonates.** Analysis of recent sediments and organisms and their Pleistocene analogs. One-week field trip. Pass/fail grading only. Prerequisite: Geology 110L or consent of instructor. 1 unit. *Perkins*

**218. Geological Fluid Mechanics.** Physical properties of fluids. Continuity, momentum, and energy principles. Laminar and turbulent flow; potential flow; open channel flow. Applications to stream and watershed hydraulics, sediment transport, and other geological phenomena. Corequisite: Geology 250. Prerequisites: Engineering 75L, Mathematics 31 and 32, or Physics 41L and 42L. 3 units. *Haff*

**219. Sediment Transport.** The processes by which wind and water move sedimentary material. Corequisite: Geology 250. Prerequisites: Civil Engineering 122L or Geology 41 and 218. 3 units. *Haff*

**220. Earth Surface Processes and Geomorphology.** The origin, nature, and significance of natural features on the earth's surface. Content varies from year to year. Prerequisites: open to graduates and advanced undergraduates with consent of instructor. 3 units. *Haff*

**221. Hydrogeology.** Theory of groundwater flow and solute transport with application to geologic processes. Corequisite: Geology 250. Prerequisite: Chemistry 12L, Mathematics 103, Physics 42L or 52L, or consent of instructor. 3 units. *Rojstaczer*

**222L. Statistics and Data Analysis in Earth and Ocean Science.** Techniques commonly used by earth and ocean scientists for the analysis of spatial and/or temporal series of data. Topics include regression, Fourier analysis, nonparametric spectral analysis, and, perhaps, principal components analysis and parametric spectral estimators. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32, Statistics 110 or 112, or consent of instructor. C-L: Environment 252L and Marine Sciences. 4 units. *Howd*

**223. Numerical Methods in Hydrogeology.** Forward and inverse modeling of groundwater flow and transport. Corequisite: Geology 250. Prerequisite: Computer Science 8 or 53, Geology 221, Mathematics 103, or consent of instructor. 3 units. *Rojstaczer*

**225S. Advanced Topics in Hydrogeology.** Hydrologic controls on the chemical and physical state of the earth's crust. Prerequisite: Geology 221 or consent of instructor. 3 units. *Rojstaczer*

**233S. Oceanic Crust and Ophiolites.** Structure, tectonics, petrology, and geochemistry of oceanic spreading environments and ophiolite complexes. Prerequisites: Geology 106L and 130 or consent of instructor. 3 units. *Karson*

**237S. Structure and Evolution of the Appalachian Orogen.** Overview of sedimentation, deformation, and metamorphism responsible for the development of the Appalachian Mountain Belt from Newfoundland to Alabama in the context of plate tectonics. Prerequisites: Geology 106L, 110L, and 130 or consent of instructor. 3 units. *Karson*

**249. Marine Micropaleontology.** Introduction to marine microfossils, basic principles of micropaleontology and stable isotope geochemistry with applications to paleo-oceanography. Lectures and laboratory. 3 units. *Corliss*

**250. Applied Mathematics for the Environmental and Earth Sciences.** Overview of quantitative methods used in modeling and data analysis of environmental and geologic problems. 3 units. *Staff*

**251. Introduction to Geophysics.** A survey of the earth's heat flow, gravitational, magnetic, and electrical potential fields, and global seismology. Derivation of basic relationships and their application to the solution of geological problems. Corequisite: Geology 250. Prerequisite: upper-division mathematics or science courses. 3 units. *Malin*

**252. Seismic Exploration of the Lithosphere.** A survey of seismic wave generation, propagation, detection, analysis, and interpretation in the continental and oceanic lithosphere with practical applications to geological and industrial problems. Prerequisites: upper-division mathematics or science courses and Geology 250. 3 units. *Malin*

**255. Theoretical Geophysics I: Diffusion and Wave Motion in the Earth, Part I.** Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series analysis. Emphasis varies depending on enrollment. Prerequisite: enrollment in an advanced degree program in earth sciences or related fields, or consent of instructors. 3 units. *Malin and Rojstaczer*

**256. Theoretical Geophysics II: Diffusion and Wave Motion in the Earth, Part II.** Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series analysis. Emphasis varies depending on enrollment and the contents of Geology 255. Prerequisite: Geology 255 or consent of instructors. 3 units. *Malin and Rojstaczer*

**258S. Advanced Topics in Geophysics: Interdisciplinary Approaches to Problems in Tectonics, Seismology, and the Environment.** Crustal structure of the western United States; use of seismic reflection and microearthquake data for imaging active geological processes, earthquake prediction; scattering of seismic waves. Consent of instructor required. 3 units. *Malin*

**269. Theoretical Geochemistry.** Introductory thermodynamics applied to geologic problems through understanding of phase equilibrium. Prerequisites: Geology 105L (may be concurrent) and Mathematics 32. 3 units. *Boudreau*

**272. Biogeochemistry.** Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. 3 units. *Schlesinger*

**273S. Analytic Techniques.** An introduction to advanced analytic procedures used in the earth sciences: such as electron microbeam techniques (scanning electron micros-



copy, electron microprobe analysis) and plasma emission/absorption spectroscopy. Consent of instructor required. 3 units. *Boudreau and Klein*

**275. Economic Geology.** Geology and geochemistry of ore deposits. Consent of instructor required. 3 units. *Baker and Boudreau*

**285S. Layered Intrusions.** Survey of layered igneous intrusions and current theories on crystallization and other processes in mafic magmas. Offered alternate years. Prerequisites: Geology 105L and 106L or consent of instructor. 3 units. *Boudreau*

**292. Computer Methods in Geology.** Techniques used in the geological sciences including simulation and forward modeling, inverse and least squares methods, statistical methods and exploratory data analysis as well as graphics. Prerequisites: Computer Science 53 and Mathematics 32, or consent of instructor. 3 units. *Staff*

**293S. Frontiers of Geology I.** Survey of the history, status, and trajectory of "hard-rock" petrology, structural geology, tectonics, and geophysics. 3 units. *Karson and staff*

**294S. Frontiers of Geology II.** Survey of the history, status, and trajectory of "soft-rock" petrology, stratigraphy, sedimentation, geochemistry, hydrology, and paleontology. 3 units. *Karson and staff*

**295S. Advanced Topics in Geology.** Topics, instructors, and credits to be arranged each semester. Variable credit. *Staff*

#### **For Graduates**

**371, 372. Advanced Topics in Geology.** To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. Variable credit. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**217. Field Analysis of Ancient Sedimentary Sequences**

**230S. Advanced Topics in Structural Geology and Tectonics**

**236S. Lithosphere Plate Boundaries**

**239S. Advanced Topics in Structural Geology and Tectonics**

**260S. Applied Subsurface Stratigraphy**

**270. Sedimentary Geochemistry**

**271. Isotope Geochemistry**

**283S. Experimental Methods in Geology**

### **German Studies Program**

Professor Rolleston, *Chair* (116L Old Chemistry); Associate Professor Morton, *Director of Graduate Studies* (116E Old Chemistry); Professors Alt (German), Antonovics (botany), Bernstein (law), Borchardt (German), Brandon (philosophy), Counce (cell biology), Herzog (divinity), Hillerbrand (religion), Jameson (literature), Kitchelt (political science), Klopfer (zoology), Lahusen (Slavic), Silbiger (music), Steinmetz (divinity), Surin (literature), and Todd (music); Associate Professors Berger (divinity), Gillespie (political science), Gilliam (music), Koonz (history), Robisheaux (history), and Van Miegroet (art); Assistant Professors Cernuschi (art), Coles (political science), Fischer (literature), Hachohen (history), Hell (German), Janoski (sociology), Pfau (English), Rasmussen (Ger-



man), Risholm (German), Stiles (art), and Walther (German); Adjunct Associate Professor Ward (philosophy)

The Interdisciplinary Program in German Studies offers graduate work leading to the Ph.D. degree. A student's program will be structured among four general disciplinary areas: history and society, literature and linguistics, fine arts and music, philosophy and religion. All students will do some course work in each of the areas, with additional basic requirements in literature and linguistics. A student will elect one of the four areas for comprehensive study; the dissertation topic will normally emerge from that specializing process, and will be grounded in the appropriate disciplinary methodology. Prior to admission to Ph.D. candidacy, students must demonstrate a reading knowledge of at least one language other than English or German. Determination of which language or languages fulfill this requirement will depend on the student's chosen area of concentration and specific research plans.

A qualifying examination, to be taken in three parts, must be passed before a student may proceed to candidacy and the writing of the dissertation. Part I, to be taken at the end of the second full year of study, will be a general examination devoted to major issues and topics in German history and culture. (Students concluding their studies at this point will be asked to submit and defend an A.M. essay for the master's degree.) Part II, the Ph.D. preliminary examination, will be devoted to a single historical period, problem, or genre in the student's chosen area of concentration and will be based on a reading list approved by the student's faculty committee. (Successful completion of this stage of the qualifying examination constitutes admission of the student to Ph.D. candidacy.) For Part III, to be devoted to the dissertation proposal, the student will evolve and master the bibliography for the anticipated dissertation, articulate the methodological and research problems involved, and present a substantial sample of the project.

Students in other departments needing a course in German for Reading Knowledge should see the undergraduate bulletin.

### **Courses in the Department of Germanic Languages and Literature**

**200S. Proseminar: Introduction to Literary Criticism.** Literary theory within the framework of Germanistik, combining a survey of the major critical approaches which developed after 1945 with the discussion of several paradigmatic readings of literary texts. Approaches studied include New Criticism, hermeneutics, Marxist critical theory, reception aesthetics, structuralism, poststructuralism, and feminist literary criticism(s). 3 units. *Hell*

**201. Introduction to Middle High German: The Language of the German Middle Ages and Its Literature.** Fundamentals of medieval German language acquired through readings in the original Middle High German of Arthurian romance, heroic epic, and courtly poetry. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

**202S. Medieval Seminar.** Topics may include: heroic epic, courtly epic, medieval poetics, German lyric poetry from the twelfth to the fifteenth century. Solid reading knowledge of modern German and some knowledge of medieval German required. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

**203S. Sex, Gender, and Love in Middle High German Literature.** Historical contexts for emergence of courtly love and the role of desire and interpretation in Gottfried von Strassburg's *Tristan und Isolde*, courtly love lyric, "maere." C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

**210S. Renaissance and Reformation.** The development of "personality" from "type" to "individual" in German culture in the great transition from medieval to early modern times, with examples from literature, history, art, architecture, music, science,

and religion. Emphasis on the Italian connection, northern mysticism, Prague in the fourteenth century, fifteenth-century poetry and prose, and Luther. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

**215S. German Baroque Literature.** German literature of the grand gesture, of performance, of public posture; poetry of rhetoric; prose of the scoundrel, adventurer, and ne'er-do-well. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

**225S. Introduction to Goethe.** Major works of lyric, narrative, drama, and theory, throughout Goethe's career. 3 units. *Morton*

**226S. Goethe's *Faust*.** Goethe's masterpiece and life's work, conceived as a summation of Western literature and mythology for the modern age. 3 units. *Morton*

**227S. Goethe Seminar.** Selected texts or other aspects of Goethe's life and work not treated in German 225S or 226S. Topics may include autobiography, scientific writings, longer novels, late lyrics, literary theory and criticism, as well as others. 3 units. *Morton*

**229S. Schiller: Aesthetic Theory and Practice.** The nature and function of the artist and the work of art, in Schiller's essays, poetry, and dramas. 3 units. *Borchardt, Morton, or Rolleston*

**230S. German Romanticism.** The emergence in the 1790s of a new cultural language: categories of self, history, interpretation, irony, and revolution. Theory, fiction, and poetry by Novalis, the brothers Schlegel, Tieck, Brentano, Eichendorff, Hoffmann, and Heine. 3 units. *Rolleston*

**232S. The Lyric: Goethe to the Present.** Poetry and its cultural meanings from versions of the modern *Ich* generated by Goethe, Hölderlin, and the romantics to the ironic new subjectivity of the 1970s. Emphasis on Mörike, Heine, Droste-Hülshoff, Rilke, Benn, Celan, Enzensberger, and Karin Kiwus. 3 units. *Rolleston*

**233S. German Theater as Anti-Drama.** The story of modern and postmodern drama with emphasis on Lenz, Büchner, Grabbe, Schnitzler, Brecht, Frisch, Dürrenmatt, Handke, expressionist drama, and Piscator's political theater. 3 units. *Alt*

**236S. Empires of the Mind: Nineteenth-Century German Ideas.** Selected topics in politics, religion, society, and history in the nineteenth century: Heine, Hegel, Schopenhauer, Feuerbach, Marx, Nietzsche, Burckhardt, Treitschke, Ranke, D. F. Strauss, Tönnies, Weber, Freud. 3 units. *Alt*

**244A, S. International Expressionism.** Not open to students who have taken Art 244S or German 244S. See C-L: Art 244A. 3 units. *Cernuschi and Rolleston*

**244B, S. International Modernism.** See C-L: Art 244B. 3 units. *Cernuschi and Rolleston*

**245S. The Twentieth Century.** The major movements and writers from the expressionists, Thomas Mann, Kafka, Rilke, and Brecht, to Böll, Grass, Handke, and Christa Wolf. Emphasis on relations between text and history: World War I, Weimar, Third Reich, and the struggle to integrate past and present in post-Holocaust literature. 3 units. *Rolleston*

**246. German Letters in the Third Reich and in Exile.** German literature, drama, and film inside and outside Nazi Germany. Theoretical readings in Bloch, Benjamin, and others. 3 units. *Hell*

**247S. Postwar German Literature.** The development of German literature after 1945. Topics vary: German literature between 1945 and the founding of the two states;



the GDR novel and the question of realism; GDR drama after Brecht; West German literature. 3 units. *Hell*

**248S. German Film from Weimar to Fascism.** German film from its inception through the Nazi period. Emphasis on the social, political, and cultural background of the period as well as specifics of film form and analysis. Focus on areas such as expressionist cinema, the realist film, Nazi propaganda and entertainment films. Taught in English. 3 units. *Risholm*

**249S. New German Cinema.** Postwar German film beginning with the popular "homeland" film and moving on to New German Cinema, emphasizing the social, political, and cultural background of the period. Diverse topics such as feminist filmmaking, auteur artists, contemporary cinema, and the Nazi past. The writings of filmmakers as well as theoretical issues in film criticism. 3 units. *Risholm*

**250S. German Literature and Classical Antiquity.** The reception of Greece and Rome in German letters; the triumph and decline of classical rhetoric; the idea of the "classical"; antiquity as model and reproach. 3 units. *Borchardt*

**253S. The Image of America in German Literature.** Selected readings in the myth of America (Jantz's "America in German Poetry and Thought"), including various genres from the eighteenth to the twentieth centuries, specifically texts by Goethe, Heine, Sealsfield, Kürnberger, Willkomm, Gerstäcker, Lenau, Solger, Kafka, Brecht, and Frisch. 3 units. *Alt*

**254S. Literature by Women.** Topics may include: the beginnings of women's writing; gender, history, and literary representation in the work of twentieth-century women writers; women writers from World War II to the present. Bachmann, Fleisser, Keun, Kolmar, Langgässer, Lasker-Schüler, Leutenegger, Rinser, Sachs, Seghers, and Wolf. Not open to students who have taken German 106S. C-L: Women's Studies. 3 units. *Rasmussen*

**260. History of the German Language.** Phonology, morphology, and syntax of German from the beginnings to the present. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

**261. Second-Language Acquisition Theory and Practice.** Modern teaching techniques; problems in the teaching of German on the secondary and college levels. Analysis and evaluation of textbooks, related audiovisual materials, and computer programs. 3 units. *Staff*

**262. Applied Linguistics.** The application of modern linguistic principles to a systematic study of the phonetics, morphology, and syntax of modern German. 3 units. *Staff*

**265, 266. Elementary German for Business and Law.** An accelerated course providing the fundamentals of German grammar, syntax, and culture, with special attention to the terminology of business and law. Exposure to audio- and computer-assisted instructional materials. Open only to graduate and professional school students. 3 units each. *Bernstein*

**270. Consciousness and Modern Society.** The blend of philosophy, literature, and sociology in German thinking about actual and possible societies. The idea of consciousness as producing involvement, detachment, or transformation. Marx, Nietzsche, Lukacs, Freud, Marcuse, Benjamin, Adorno, and Habermas. Taught in English. 3 units. *Rolleston*

**271S. Contemporary Theory and the German Tradition.** The reorientation of Western thought toward theories of knowledge and of language, from the eighteenth



century to the present, and the significance of that paradigm shift for contemporary theory of literature and literary criticism. Readings in Kant, Herder, Mauthner, Wittgenstein, Heidegger, Habermas, and Apel. Taught in English. 3 units. *Morton*

**299S. Seminar in German Studies.** Review of current debates and historical perspectives in the German cultural field, structured through contributing disciplines: social and economic history, political theory and history, literature, fine arts, music, philosophy, and religion. Team-taught, involving a wide range of faculty in the German Studies Program. 3 units. *Morton or Rolleston and staff*

**300S. The Discipline of *Germanistik*: A Historical Survey.** A study of trends in scholarly criticism within the context of German culture and politics beginning in the 1810s with the origins of *Germanistik* as a university discipline. Topics may include: the invention of philology and the romantic enterprise; positivism and *Geistesgeschichte*; the politics of *Germanistik*, 1933–45; *Germanistik* in Europe and the United States after 1945. 3 units. *Alt, Borchardt, or Rasmussen*

**301. German Studies: Theory and Practice.** German studies at the intersection of various discourses (such as feminism, psychoanalysis, new historicism), questioning traditional concepts such as national identity, history, and language. Interdisciplinary issues may include: the relationship of literature, the unconscious and technology; the cinematic representation of Nazi history; architecture, monuments, and "German" space. Texts might include works by Kafka, Freud, Marx, Spengler, and Schinkel as well as texts by individuals whose work has been excluded from more traditional "Germanistik" courses. 3 units. *Risholm*

#### **COURSES CURRENTLY UNSCHEDULED**

**220S. Reason and Imagination: The German Eighteenth Century**

**231S. Romantic Outsiders**

**235S. Nineteenth-Century German Literature**

**240S. Naturalism and Beyond: The Turn of the Century**

**241S. Nietzsche**

**242S. Expressionism**

**251S. Germanic Mythology and Its Critics**

**252S. The Mystical Tradition**

**255S. Paradigmatic Issues in Literary Theory**

**272S. The German Literature of Fantasy**

**273S. Franz Kafka and Thomas Mann**

**274S. The Image of America in German Literature**

**275S. German Women Writers**

**321, 322. Germanic Seminar**

#### **GERMAN STUDIES COURSES IN OTHER DEPARTMENTS**

##### **Art and Art History**

243S. Topics in Netherlandish and German Art

283S. Topics in Modern Art

297S. Topics in Art since 1945

299S. Critical Theory

**History**

- 204. German Society, 1914-1945
- 253S, 254S. European Diplomatic History, 1871-1945
- 258S. Social Conflict in Weimar and Nazi Germany

**Literature**

- 251. History of Criticism
- 252. Criticism and Literary Theory in the Twentieth Century
- 281. Paradigms of Modern Thought
- 283. Modernism
- 285. Literature and Ideology
- 293. Seminars in Literature and History
- 298. Topics in Philosophy and Literature

**Music**

- 222. Music in the Middle Ages
- 223. Music in the Renaissance
- 224. Music in the Baroque Era
- 225. Music in the Classic Era
- 226. Music in the Nineteenth Century
- 227. Music in the Twentieth Century
- 236. Nineteenth-Century Piano Music

**Philosophy**

- 231S. Kant's Critique of Pure Reason
- 232S. Recent Continental Philosophy
- 233S. Methodology of the Empirical Sciences
- 234S. Problems in the Philosophy of Biology
- 235S. Nineteenth-Century German Philosophy

**Political Science**

- 216S. Evolution of European Marxism
- 225S. Topics in Comparative Government and Politics: Western Europe
- 228S. Nineteenth- and Twentieth-Century Political Philosophy
- 231S. Crisis, Choice, and Change in Advanced Democratic States
- 236S. Hegel's Political Philosophy
- 239. Comparative History and International Studies
- 247. Politics and Philosophy of Self and Other

**Psychology: Social and Health Sciences**

- 204S. Great Ideas in Psychology

**Religion**

- 228. Twentieth-Century Continental Theology
- 231S. Seminar in Religion and Contemporary Thought
- 232S. Religion and Literary Studies
- 236. Luther and the Reformation in Germany
- 248. The Theology of Karl Barth
- 297. Philosophical and Theological Discourses on Modernity
- 320. Theology, Power, and Justice
- 322. Nineteenth-Century European Theology
- 338. Calvin and the Reformed Tradition
- 339. The Radical Reformation

**Slavic Languages and Literatures**

- 210. Literature and Criticism of Socialist Realism
- 250. Trends in Russian and East European Literary Criticism and Beyond

**Sociology**

- 206. Sociological Theory

**Divinity School Courses**

- 201. Christian Thought in the Middle Ages
- 241. Problems in Reformation Theology
- 262. Marxist Ideology and Christian Faith
- 272. Theology of Paul Tillich
- 303. Philosophical Method in Religious Studies
- 328. Twentieth-Century European Theology

## Health Administration

A concentration in Health Administration is offered through the Masters in Business Administration degree program of the Duke University Fuqua School of Business. Please contact that school directly for more information.

## History

Professor Chafe, *Chair* (215 Carr); Professor Gavins, *Director of Graduate Studies* (212A Carr); Professors Cell, Dirlik, Gaspar, Goodwyn, Gordon, Herrup, Hewitt, Keyssar, Koonz, Kuniholm, Lerner, Mauskopf, Mendelsohn, Miller, Oates, Reddy, Richards, Roland, Shatzmiller, TePaske, Thompson, Witt, and Wood; Associate Professors English, Ewald, James, Nathans, Neuschel, and Robisheaux; Assistant Professors French, Green, Hachohen, Humphries, Mazumdar, Peyroux, J. Scott, Thorne, and Wigen; Professors Emeriti Cahow, Colton, Davis, Durden, Ferguson, Franklin, Holley, Parker, Preston, Ropp, A. Scott, W. Scott, Watson, and Young

The Department of History offers graduate work leading to the A.M. and Ph.D. degrees. Candidates for the A.M. degree must have a reading knowledge of at least one ancient or modern foreign language related to their programs of study and have completed successfully a substantial research paper, or two seminar papers, normally the product of a year's seminar or two semester courses. The paper(s) must be examined and approved (at a required A.M. meeting) by three readers: the supervising professor and two other professors from the graduate staff. Students anticipating a May degree must have their papers read and approved by April 15; those anticipating a September degree must have their papers read and approved by August 1.

Candidates for the degree of Doctor of Philosophy prepare themselves for examinations in four fields, at least three of which shall be in history. The choice of fields is determined in consultation with the student's supervisor and the director of graduate studies. The department offers graduate instruction in the broad historical areas of North America; Latin America; Great Britain and the Commonwealth; ancient, medieval, and Renaissance Europe; modern Europe; Russia; Japan; China; South Asia; military; history of science, technology, and medicine; and in the comparative and thematic fields of women's history, environmental history, diplomatic history, labor history, and slave societies.

The candidate for the Ph.D. degree must demonstrate a reading knowledge of one foreign language, ancient or modern, prior to the preliminary examination. All students are expected to take History 301-302 in their first year, unless entering with an A.M. in history. In addition, each student must fulfill a general methodology requirement, by completing at least one course which would appreciably increase the candidate's methodological proficiency. With the approval of the director of graduate studies, options include taking a graduate class in methodology, such as demography, statistics, oral history, archaeology, cartography, or a summer training program for developing specific methodological skills. Students who need to master a second foreign language may substitute that language for the methodology requirements.

**Ancient History.** For courses in ancient history which may be taken for credit in either history or classical studies, see Classical Studies.

### For Seniors and Graduates

Students may receive credit for either semester of a hyphenated course at the 200 level without taking the other semester if they obtain written consent from the instructor.

**201S. The Russian Intelligentsia and the Origins of the Revolution.** Origin and dynamics of the Russian revolutionary movement, the intelligentsia, and the emergence of the labor movement. 3 units. *M. Miller*



**202S. The Russian Revolution.** An analysis of the Bolshevik seizure of power in 1917 and the establishment of a revolutionary society and state during the 1920s. 3 units. *M. Miller*

**203. Topics in Modern World Environmental History.** Human effects upon the natural environment; case studies and a synthetic global perspective. 3 units. *Richards*

**206. Origins of Afro-America.** A comparative and interdisciplinary approach to early history of Africans in the Western hemisphere. Uses anthropological, linguistic, and archeological literature in addition to historical studies to examine the origins of the diverse African-American cultures of the Americas. 3 units. *J. Scott*

**209S. Race, Class, and Gender in Modern British History.** The intersection between gender, race, and class identities in British history since the eighteenth century. The parallels and overlaps as well as the disjunctures and distinctions between these different modes of power in a period of tremendous economic, social, and political change resulting from industrialization and imperial expansion. Questions and issues include the impact of industrialization on gender as well as class consciousness, the role of women, the middle classes and the working classes in the campaign against slavery, British workers' reactions to the "scramble" for colonies, the attitudes and activities of British women in the empire, and sexuality and the evolution of racist discourse. 3 units. *Thorne*

**210S. Anthropology and History.** Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. See C-L: Cultural Anthropology 207S. 3 units. *Reddy*

**211A. History of Medicine in the Southern United States.** The social history of disease and medical practice in the southern United States from the colonial era to World War II. Topics will include the impact of disease on the region's settlement and economy, slave health, the role of "alternate practitioners," and the growing federal presence in the post-Reconstruction South. 3 units. *Humphreys*

**214. Class, Public Opinion, and the French Revolution.** The current state of the ongoing controversies over the origins and character of the first modern social revolution. 3 units. *Reddy*

**216S. United States Diplomacy, 1890-1945.** 3 units. *Staff*

**217. Problems in American Colonial History.** 3 units. *J. Scott*

**219S, 220S. History of Science and Technology.** The interaction of science and technology in the Western world from earliest times to the present. 3 units each. *Mauskopf and Roland*

**221. Topics in the Social and Economic History of Europe, 1200-1700.** C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**222. Problems in the Intellectual History of the European Renaissance and Reformation.** Prerequisites: History 151A, 151B and reading knowledge of German, French, or Italian. C-L: Medieval and Renaissance Studies. 3 units. *Witt*

**223S, 224S. The World Wars.** The causes, course, and consequences of World Wars I and II, from military, political, and economic perspectives; the legacy of World War II; special emphasis on understanding the experience of total war—not only for the individual soldier but for whole societies. 3 units each. *Biddle*

**225S. Problems in Comparative Labor History.** Common dilemmas and varying solutions in the cross-national development of labor-management relations, their polit-

ical implications, and their larger historical significance. 3 units. *French, Gordon, or Keyssar*

**226. Topics in the Labor History of the United States.** 3 units. *Keyssar*

**230S. Populism in Latin America.** An examination of the various theoretical frameworks developed for Latin American populism, followed by case studies focusing on issues such as the emergence of a modernizing state, the role of the masses in populist movements, and the class content and ideological and cultural parameters of such movements. 3 units. *James*

**233S. Slave Resistance and Social Control in New World Societies.** The operation of slave societies in the Americas from the sixteenth to the nineteenth centuries focusing on master-slave relations and slave resistance. 3 units. *Gaspar*

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S and Sociology 234S. 3 units. *Staff*

**235S. The Antebellum South.** The economic, political, and social aspects of life in the South, 1820-1860. 3 units. *S. Nathans*

**237S. Europe in the Early Middle Ages.** C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**238S. Europe in the High Middle Ages.** C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**239. History of Socialism and Communism.** The origins and development of socialist and communist movements from pre-Marxian times to the present. Not open to students who have taken History 120. 3 units. *Lerner*

**240A. Multinationalism and Multiculturalism: Eastern Europe Example.** 3 units. *Lerner*

**241A. Origins of Totalitarianism.** 3 units. *Hacohen*

**247. Mughal India.** 3 units. *Richards*

**248. History of Modern India and Pakistan, 1857 to the Present.** 3 units. *Richards*

**251A. Topics in Intellectual History of Europe, 1250-1450.** C-L: Medieval and Renaissance Studies. 3 units. *Witt*

**251B. Topics in Intellectual History of Europe, 1450-1650.** C-L: Medieval and Renaissance Studies. 3 units. *Witt*

**252A. Construction of China in European and American Literature.** An examination, starting with Marco Polo's account of China, of representations of China in Euro-American writing toward an understanding of a Euro-American discourse on China. Emphasis on fiction, but consideration as well of the relationship between fictional and nonfictional writing (especially history, geography, and travelogue). While the approach is historical, contemporary representations of China are of primary concern. Not open to students who have taken History 252. 3 units. *Dirlik*

**252B. Culture and Society in Contemporary China.** Developments in Chinese society and culture since 1978, focusing on social changes in China and on matters of culture. Culture here includes debates on culture and history, as well as various forms of cultural production (literature, film, and popular culture). Parallel developments in Pacific Asia (Japan, Taiwan, and Hong Kong, in particular). 3 units. *Dirlik*



**253S, 254S. European Diplomatic History, 1871-1945.** Origins of the First and Second World Wars, the diplomacy of the wars, and the peace settlements which followed them. 253S: 1871-1918; 254S: 1919-1945. 3 units each. *Staff*

**255A, S. Development of United States Courts of the Fourth Circuit.** Consent of instructor required. See C-L: Political Science 238S; also C-L: Law 548S. 3 units. *Fish*

**256. Modern Literature and History.** See C-L: French 256. 3 units. *Orr*

**257. Comparative Latin America Labor.** An interdisciplinary examination of the monographic literature on Latin-American labor in the twentieth century. 3 units. *French*

**258S. Social Conflict in Weimar and Nazi Germany.** The interactions between emancipation and backlash; military defeat and patriotism; political equality and biopolitics; dissent and repression; and among propaganda, bureaucratic chaos, and police terror. 3 units. *Koonz*

**260. Fifth and Fourth Century Greece.** See C-L: Classical Studies 222. 3 units. *Oates or Rigsby*

**262. The Soviet Experience.** A survey of the history of Russia and the Soviet Union from the eve of the Revolution to the present day with particular emphasis on political, social, and cultural change and continuity. Not open to students who have had History 180. 3 units. *Lerner*

**263. The Roman Republic.** See C-L: Classical Studies 224. 3 units. *Boatwright or Rigsby*

**264. The Roman Empire.** See C-L: Classical Studies 225. 3 units. *Boatwright*

**265S. Problems in Modern Latin American History.** 3 units. *Staff*

**267S. England in the Sixteenth Century.** C-L: Medieval and Renaissance Studies. 3 units. *Herrup*

**268S. England in the Seventeenth Century.** C-L: Medieval and Renaissance Studies. 3 units. *Herrup*

**271S. The Law of War.** The evolution of constraints on warfare in the Western world, both codified and customary. The concept of the "just war" as well as restrictions on the conduct of combat (ground, naval, and aerial) as they have evolved over time. 3 units. *Biddle*

**272S. Fin-de-siècle and Interwar Vienna: Politics, Society, and Culture.** Advanced undergraduate seminar in intellectual history focusing on the cultural milieu of fin-de-siècle and interwar Vienna. 3 units. *Hacohen*

**273S, 274S. Topics in the History of Science.** Critical stages in the evolution of scientific thought. 3 units each. *Mauskopf*

**275S. Asian and Asian-American Women in Comparative Perspective.** A woman-centered approach to the history of colonialism and nationalist struggles in Asia, the evolution of racialist discourse and its impact on Asian immigration to the United States. 3 units. *Mazumdar*

**277S. The Coming of the Civil War in the United States, 1820-1861.** 3 units. *Durden*

**278S. The Civil War in the United States and Its Aftermath, 1861-1900.** 3 units. *Durden*

**279, 280. Health, Healing, and History.** The development of medicine within the broader cultural context from prehistory to the twentieth century. 3 units each. *English*



**281S. United States' Diplomacy since 1945.** 3 units. *Staff*

**282S. Canada.** A research seminar for advanced students familiar with Canada. Topics vary each semester; recent perspectives have included nationalism, Canadian-American relations, regionalism in the Maritimes and the West, and cross-border environmental issues, among others. C-L: Cultural Anthropology 282S, Economics 282S, Political Science 282S, and Sociology 282S. 3 units. *Staff*

**284S. Feminist Theory and the Social Sciences.** See C-L: Women's Studies 284S; also C-L: Cultural Anthropology 284S, Political Science 264S, Psychology: Social and Health Sciences 284S, and Sociology 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spinner*

**285S, 286S. Oral History.** Research on race relations and civil rights in the United States in the twentieth century using techniques of oral history. Consent of instructor required. 3 units each. *Chafe and Goodwyn*

**287S. American History and Social Theory.** Contemporary theories of social order, social change, and revolution. 3 units. *Goodwyn*

**288S. Germany and Japan in World War II.** A comparative inquiry into the experience of these two capitalist "late developing" nations that turned to fascism and militarism in the 1930s. Topics include business and the state in wartime mobilization, wartime labor and productivity, the experience of women at work and at home, impact of firebombings, wartime propaganda and racism, postwar memory of the wartime era. 3 units. *Gordon and Koonz*

**289S. War, Revolution, and Society in the Caribbean 1700-1815.** Explores the complex impact of European imperialism and the American, French, and Haitian revolutions upon Caribbean societies to the end of the Napoleonic wars. Military, economic, social, political, and institutional theories examined. 3 units. *Gaspar*

**290S. Theoretical Bases of Social Interpretation.** An interdisciplinary course on the historical development of theoretical formulations of particular importance to social historians and cultural anthropologists. Examines several fundamental problems posed by any effort to interpret social life. Considers how these problems show up and are handled within a number of approaches, loosely grouped as metaphysics, language, identity, and practice. C-L: Cultural Anthropology 220S. 3 units. *Reddy*

**291S. Modern Jewish Politics.** The development of the main currents in modern Jewish politics—nationalism, integrationism, and orthodoxy. Emphasis on the activities of these political movements in Europe and in the United States in the twentieth century. The influence of these movements on Israel. 3 units. *Mendelsohn*

**292. Research Methods in Japanese.** See C-L: Japanese 291; also C-L: Cultural Anthropology 290. 3 units. *Staff*

**295S. Slavery and Freedom in Africa, to 1960.** How Africans created variations on the global themes of servility, slavery, and freedom. Includes various forms of slavery in Africa; gender and slavery; slave trades; the impact of the Atlantic economy on slavery in Africa; colonial policies of "emancipation," labor control, and labor coercion; African intellectual responses to the problem of slavery and African expressions of freedom, including freedom from colonial rule. 3 units. *Ewald*

### **Required Courses for Graduates**

**301-302. Research Seminar in History.** This seminar is required of all entering first-year doctoral candidates in history. 6 units. *Staff*

**312. Seminar in the Teaching of History in College.** This course is intended to acquaint students with the problems involved in teaching history in college. Required of all candidates for the degree of Doctor of Philosophy who are in residence for two years at Duke. As an alternate method of meeting this requirement, a graduate student may, in cooperation with a member of the faculty, serve a one-semester teaching apprenticeship. Supervised by director of graduate studies. No credit.

### **Colloquia and Seminars for Graduates**

**305. The British Empire: Recent Interpretations.** Colloquium emphasizes recent interpretations of the following topics: (1) the imperialism of free trade; (2) nineteenth-century India; (3) the new imperialism; (4) nationalism and decolonization (India and Africa); (5) Empire to Commonwealth; (6) imperialism and gender. 3 units. *Staff*

**306. Problems in British Imperialism.** Selected readings on significant aspects of the history of the British Empire-Commonwealth: for example, Ireland, South Africa, and India. 3 units. *Cell*

**309S, 310S. Seminar in Afro-American History, 1900 to the Present.** Historiography and research on the black experience and race relations in the age of segregation, during the Civil Rights Movement, and in the post-civil rights era. 3 units each. *Gavins*

**315. Topics in British History.** 3 units. *Thorne*

**320S. The Working Class in the United States.** 3 units. *Keyssar*

**325S. Topics in Modern American Political and Social History.** 3 units. *Keyssar*

**326S. Introduction to Military History.** Critical reading and discussion of classic works and studies representative of the major genres in the field. 3 units. *Biddle and Roland*

**327S. History of Sexuality in Europe.** 3 units. *Koonz*

**328S. War and Society in Early Modern Europe.** A study of the relationship between war, state formation, economic developments, social structures, gender relations, and art and literature between 1500 and 1789. C-L: Medieval and Renaissance Studies. 3 units. *Neuschel*

**329S. Topics in Cold War History.** 3 units. *Biddle*

**330S. Selected Topics in Brazilian History.** 3 units. *French*

**335S. Comparative Labor History.** Selected topics and methodological and historiographical controversies in the labor history of two or more world regions. 3 units. *Fink and French*

**340S. Topics in Modern Latin American Social and Political History.** Empirical case studies and methodological and historiographical themes in nineteenth- and twentieth-century Latin America. 3 units. *James*

**350. The Words and Works of Peronismo.** Explores practices and discourses associated with Peronismo in twentieth-century Argentina. Addresses questions by examining a variety of elements of Peronist archive, from literary to history accounts, from journalistic to political documents, from cinematic to plastic renderings. 3 units. *James*

**351-352. Colloquia.** Each colloquium deals with an aspect of history by means of readings, oral and written reports, and discussion, with attention to bibliography. *Ad hoc* colloquia may be worked out during registration in the various fields represented by members of the graduate faculty; these colloquia do not appear on the official

schedule of courses. In some instances, students may take the equivalent of a research seminar in conjunction with the colloquium and will be credited with an additional 6 units by registering for 371.1-372.1, etc. C-L: Women's Studies. Variable credit.

**356. History and Culture of Islamic Cairo.** See C-L: Religion 356. 3 units. *Cornell*

**371-372. Research Seminars.** To be taken either in conjunction with colloquia listed above or by special arrangement with appropriate graduate instructors when research seminars in a desired area are not offered. These seminars do not appear on the official schedule of courses. 6 units. *Staff*

**389. Seminar in Conservation and Environmental History.** Traces the evolution of conservation and environmental movements and the development of environmental ethics. History of agencies, industries, associations, and citizen groups as well as overall policies for land and resources. Comparison of parallel developments in Canada. Consent of instructor required. C-L: Environment 389. 3 units. *Steen*

### **Independent Study**

**399. Special Readings.** Supervised independent study and reading. Consent of instructor required. 3 units. *Staff*

N.B. For the most current listing of scheduled courses, please refer to the most recent Duke University official schedule of courses printed twice a year.

### **COURSES CURRENTLY UNSCHEDULED**

**204. German Society, 1914-1945**

**205S. Gender and War**

**207S. Geographic Perspectives in History I: Western Europe and the Americas**

**208S. Geographic Perspectives in History II: Asian and Pacific Worlds**

**212. The American Indian in the Revolutionary Era, 1760-1800**

**215S. The United States in International Relations: The Eighteenth and Nineteenth Centuries**

**227-228. Recent United States History: Major Political and Social Movements**

**231S. Readings in Latin American Colonial History**

**243-244. Marxism and History**

**245, 246. Social and Intellectual History of China**

**249-250. Social and Intellectual History of the United States**

**259. Archaic Greece**

**261. Alexander and the Hellenistic World**

**266. Late Antiquity**

**269S-270S. British History, Seventeenth Century to the Present**

**314. Historical and Social Science Methodology**

## **The Master of Arts Program in Humanities**

Professor A. Leigh DeNeef, *Director* (English)



The Master of Arts Program in Humanities is an interdepartmental program and is tailored to the needs of individual students. The candidate defines a theme and selects appropriate course work with the aid and approval of a supervising committee. Thirty units of course work and proficiency in a foreign language are required for completion of the program. The degree may be earned with or without a thesis. The candidate who chooses not to submit a thesis will submit instead at least two substantial papers arising from course work for review by committee members, and meets with them to discuss his or her program in a final master's colloquium.

The program is open to holders of undergraduate degrees in any discipline who can demonstrate sufficient background in humanities to permit study at the graduate level. Admission is by regular application to the Graduate School. Students may enroll full time or part time (minimum of 3 units per term). Students considering entering the program may enroll in an appropriate graduate course or courses through the Office of Continuing Education, at the same time making their interest known to the director of the Humanities Program.

## Immunology

Professor Tedder, *Chair* (353 Jones); Professor Dawson, *Director of Graduate Studies* (317 Jones); Professors Buckley, Haynes, McClay, Rosse, and Ward; Associate Professor Krangel; Assistant Professors Doyle, Markert, McHeyzer-Williams, Pisetsky, and Zhuang; Research Associate Professor Balber; Professors Emeriti Amos and Metzgar

The department offers graduate work leading to the Ph.D. degree. Research programs are available in various aspects of molecular and cellular immunology, including immunochemistry and immunogenetics. The department is also a participating member in the interdisciplinary University Programs in Cell and Molecular Biology and Genetics, and the Medical Scientist Training Program.

The department has excellent facilities for carrying out all aspects of immunologic, cell biologic, and genetic research. A brochure describing the Ph.D. program, prerequisites for admission, and research in the department may be obtained by writing to the Director of Graduate Studies, Department of Immunology, Box 3010, Duke University Medical Center, Durham, NC 27710.

**214. Fundamentals of Electron Microscopy.** See C-L: Microbiology 214. 3 units. *Miller*

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Biochemistry 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

**244. Principles of Immunology.** An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 151L or equivalents. C-L: Zoology 244. 3 units. *Kostyu, McClay, and staff*

**246S. Parasitic Diseases.** Topics in the physiology and immunology of major human and animal parasites with an emphasis on protozoa and schistosomes. Extensive reading in and discussion of current literature. Basic parasitology developed in introductory readings and lectures. Prerequisites: Biochemistry 227 or equivalent; and Immunology 244 or Immunology/Microbiology 291. C-L: Microbiology 246S. 3 units. *Balber*

**252. General Virology and Viral Oncology.** See C-L: Microbiology 252. 4 units. *Keene and staff*

**259. Molecular Biology I: Proteins and Enzymes.** Prerequisites: biochemistry, organic chemistry, and physical chemistry. See C-L: Biochemistry 259; also C-L: Cell Biology 259, Microbiology 259, and Molecular Biophysics 259. 3 units. *Fierke and staff*

**268. Molecular Biology II: Nucleic Acids.** Prerequisites: introductory biochemistry and equivalents of Biochemistry 259 and Cell and Molecular Biology 247, 277, and 278. See C-L: Biochemistry 268; also C-L: Cell Biology 268, Microbiology 268, and The University Program in Genetics 268. 4 units. *Steege and staff*

**269. Advanced Cell Biology.** Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Botany 269 and Cell Biology 269. 3 units. *Siedow and staff*

**291. Comprehensive Immunology.** An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and nonspecific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses; neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T-cell receptor. Required course for all students specializing in immunology. C-L: Microbiology 291. 4 units. *Krangel and staff*

**300. Tumor Immunology.** An advanced seminar based on original literature. Topics include a general introduction to malignancy and immune responses associated with them, regulation of the immune response to tumor, vaccine development, the role of gene therapy, the use of tumor-reactive monoclonal antibodies, and characteristics of tumor antigens. Prerequisite: Immunology 291. 2 units. *Gilboa, Tedder, and staff*

**310. Molecular Development.** See C-L: Microbiology 310. 2 units. *Linney*

**330. Medical Immunology.** A brief review of basic concepts in immunology followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. 5 units. *Ward and staff*

**332. Immunology Seminar.** Research topics in immunology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in immunology. 1 unit. *Doyle and staff*

**335-336. Current Topics in Immunology.** Focus on current immunology research, emphasizing emerging research areas and new directions in established areas. Students present recent papers in selected subjects. 2 units. *Dawson and staff*

## COURSES CURRENTLY UNSCHEDULED

**304. Molecular Membrane Biology**

## The Duke–University of North Carolina Program in Latin American Studies

Deborah Jakubs, Ph.D., *Associate Director* (2114 Campus Drive)

The Duke-UNC Program in Latin American Studies cooperates with the Council on Latin American Studies to oversee and coordinate graduate education in Latin American studies at Duke. Graduate students in Arts and Sciences as well as professional school students may concentrate their studies on Latin America. In addition to fulfilling the



requirements of their departments, students of Latin American studies may undertake special courses of interdisciplinary study, or those offered by other departments, to broaden their knowledge of the region. (For additional information about the council and the graduate certificate in Latin American Studies, see the section on "Special and Cooperative Programs" in this bulletin.)

The interdisciplinary focus of the graduate program is enhanced by the numerous activities of the Duke-UNC program, which offers graduate students at Duke an array of intellectually challenging opportunities to broaden their disciplinary training. The single most important initiative of the Duke-UNC program is the sponsorship of interdisciplinary working groups that bring together faculty and graduate students from both campuses to conduct research and training in areas of central concern to Latin American studies. The objective is to move beyond the seminar format that dominates graduate education in the social sciences and humanities, and to focus instead upon training graduate students in a manner similar to the direct research collaboration that typically characterizes training in the natural sciences. The groups focus on topics such as political economy, the environment, culture, gender issues, religious change and labor issues in Latin America. The program also sponsors a Graduate Student Colloquium designed to encourage interaction between the two graduate student bodies and administers a competition for graduate student travel grants each spring. These awards provide Duke students with the opportunity to deepen their disciplinary interests in the region through relatively brief periods of research in Latin America. In 1991 the Duke-UNC program was designated a National Resource Center for Latin American Studies by the U.S. Department of Education. This honor is accompanied by funding for a number of new activities as well as Foreign Language and Area Studies (FLAS) Fellowships for graduate students.

Further information on the activities of the program and special opportunities for graduate students may be obtained from the Duke Program Coordinator, Duke-UNC Program in Latin American Studies, 2114 Campus Drive, Box 90254, Duke University, Durham, NC 27708-0254, telephone (919) 681-3980, email: las@acpub.duke.edu.

**200S. Seminar in Latin American Studies.** Interdisciplinary study of geographical, historical, economic, governmental, political, and cultural aspects of modern Latin America and the current issues facing the region. Specific topics will vary from year to year. For juniors, seniors, and graduate students. 3 units. *Staff*

#### **Courses with Latin American Content Offered by Departments**

Biological Ecology. *Terborgh*

Botany 300. Tropical Botany. *Stone*

Cultural Anthropology 280S. Anthropology and Cultural Studies. *Starn*

Cultural Anthropology 280S. Sex, Gender, and Heresies in the Making of Colonial Latin America. *Silverblatt*

Cultural Anthropology 280S. Statemaking and Cultural Revolution. *Silverblatt*

Economics 231S. Economic Development in Latin America. *Staff*

Economics 286S. Policy-Making in Developing Countries. *Ramachandran*

Economics 319. Seminar on Development Economics II. *Krueger*

Education 205. Higher Education in Latin America. *DiBona*

English 381. Post-Colonial Literature. *Moses*

Environment 217. Tropical Ecology. *Terborgh*

Environment 277. Conservation and Sustainable Development I: Concepts and Methods. *Staff*

Environment 278. Conservation and Sustainable Development II: Integrated Problem-Solving. *Staff*

Environment 285. Land Use Principles and Policy. *Healy*

Environment 298. Special Topics on Land Use Policy. *Healy*

Environment 298.07. Protected Areas: Design, Implementation and Management. *Dugelby*

Environment 298.09. Environmental Politics and Policies in Contemporary Mexico. *Torres*

Environment 298.12. Population and Environment in Latin American Rain Forest Frontiers: A

Household Perspective. *Marquette*

History 224. History of Social Movements in Peru. *Staff*

History 225. Comparative Labor History. *Fink or French*

History 230. Populism in Latin America. *James*



- History 231S. Readings in Latin American Colonial History. *TePaske*  
 History 233. Slave Resistance and Social Control in New World Societies. *Gaspar*  
 History 257. Comparative Latin American Labor. *French*  
 History 265S. Problems in Modern Latin American History. *Staff*  
 History 289S. War, Revolution, and Society in the Caribbean. *Gaspar*  
 History 330S. Brazilian Race Relations. *French*  
 History 340S. Latin American Social and Political History. *French*  
 History 350. Words and Works of Peronism. *James or Moreiras*  
 History 351. Colloquium on Latin American Colonial History. *TePaske*  
 History 372S. Gender and Power in Latin American History. *Chambers*  
 Literature 285. Literature and Ideology. *Cooke or Mignolo*  
 Literature 285. Literature and Ideology: Worlds and Texts, C. L. R. James. *Surin*  
 Literature 287. Spanish-American Literature. *Dorfman*  
 Literature 291. Topics in Popular Culture and Media. *Willis*  
 Literature 292. Topics in Non-Western Literature and Culture: Do the Americas Have a Common Literature? *Pérez-Firmat*  
 Literature 293. El Salvador, 1980-1992. *Moreiras*  
 Literature 295. Representation in a Global Perspective. *Hardt*  
 Literature 295. Beyond Occidentalism: Rethinking How the West was Born. *Mignolo*  
 Literature 295. Representation in a Global Perspective: The Ends of Latin-Americanism. *Moreiras*  
 Literature 302. Seminar in Emergent Literatures: The Challenge of the Testimonio. *Dorfman*  
 Political Science 200. Political Economy in Latin America. *Staff*  
 Political Science 200B. Latin American Policy. *Diaz*  
 Political Science 234S. Political Economy of Development: Theories of Change in the Third World. *Coleman or Hartlyn*  
 Political Science 253S. Comparative Government and the Study of Latin America. *Archer*  
 Political Science 381. Research Seminar in Latin American Government and Politics. *Staff*  
 Political Science 399. Readings on Latin American Politics. *Archer*  
 Portuguese 200S. Cultural Heritage of the Brazilian Northeast. *Damasceno*  
 Portuguese 200S. Seminar in Luso-Brazilian Literature: Africa and the African Diaspora in Portuguese. *Anderson*  
 Public Policy Studies 264S. Natural Resources and Sustainable Development. *Miranda*  
 Public Policy Studies 267S. Policy-Making in International Organizations. *Ascher*  
 Public Policy Studies 284S. Public Policy Process in Developing Countries. *Ascher*  
 Public Policy Studies 286S. Economic Policy-Making in Developing Countries. *Conrad*  
 Public Policy Studies 325S. Program in International Development Policy Sector Seminar: Urban and Rural Development. *Ascher*  
 Public Policy Studies 327. Privatization and the Role of the State. *Arcia*  
 Public Policy Studies 327. Appropriate Technology and Transfer. *Ramachandran*  
 Public Policy Studies 327E. Structural Adjustment and Poverty. *Arcia*  
 Religion 263. Third World Theology. *Berger*  
 Sociology 222. Societal Transformation. *Gereffi*  
 Sociology 224C. Urbanization and Migration. *Muschkin*  
 Sociology 225. International Environment. *Gereffi*  
 Spanish 200S. El "Boom" de la Novela Hispano-Americana Treinta Años Después. *Bianchi*  
 Spanish 241. Colonial Prose of Spanish America. *Staff*  
 Spanish 245. Modern Spanish-American Poetry. *Fein*  
 Spanish 248. Studies in Spanish-American Literature. *Dorfman or staff*  
 Spanish 341. Colonial Prose of Spanish America. *Ross*  
 Spanish 342. Colonial Poetry and Theater of Spanish America. *Ross*  
 Spanish 344. Philosophy, Culture, and History in Latin America: The Politics of Labeling. *Mignolo*  
 Spanish 346. Modern Spanish-American Fiction. *Pérez-Firmat*  
 Spanish 391. Hispanic Seminar. *Staff*  
 Spanish 392. Theory of Latino Literature. *Dorfman or Pérez Firmat*  
 Spanish 392. Repression and Resistance in the Southern Cone. *Dorfman*  
 Spanish 392. Alfabetización de Traducciones Orales. *Mignolo*  
 Spanish 392. Narrativas de Objeto Periódico. *Moreiras*  
 Spanish 392. Literature of Emerging Countries. *Bianchi or Dorfman*  
 Spanish 392. Julio Cortazar. *Dorfman*

## The Master of Arts in Liberal Studies Program

Diane Sasson, Ph.D., *Director*

This interdisciplinary program allows individuals with a variety of professional and personal educational interests the flexibility to pursue their goals across traditional

disciplinary boundaries. The program is managed by an interdepartmental committee which admits students, selects courses, and determines policy. Students study primarily on a part-time basis and choose from an array of interdisciplinary courses developed specifically for this program. In addition to the special liberal studies courses, students may select courses from other departments in the Graduate School.

The MALS program consists of nine courses and a final project. These courses are offered during three academic terms (fall, spring, and summer) and may be taken either on a full-time or part-time basis. For more information on specific courses and other program requirements, a separate bulletin on the Master of Arts in Liberal Studies may be requested from the Program Director (Box 90095, Duke University, Durham, North Carolina 27708, (919) 684-3222).

## The Program in Literature

Professor Jameson, *Chair* (Graduate Program in Literature and French); Professor Surin, *Director of Graduate Studies* (Graduate Program in Literature and Religion); Professors Fish (English and law), Kaplan (French and Graduate Program in Literature), Lentricchia (Graduate Program in Literature and English), Mignolo (Spanish and Graduate Program in Literature); Moi (Graduate Program in Literature and French), Mudimbe (Graduate Program in Literature, French, and cultural anthropology), Radway (Graduate Program in Literature), Rolleston (Germanic languages and literature), B. H. Smith (Graduate Program in Literature and English), Stewart (French), Thomas (French and Graduate Program in Literature), and Tompkins (English); Associate Professor Gaines (Graduate Program in Literature and English); Assistant Professors Fischer (Graduate Program in Literature and Spanish), Hardt (Graduate Program in Literature), and Moreiras (Spanish and Graduate Program in Literature); Research Professor Dorfman (Graduate Program in Literature and Latin American studies)

The interdepartmental program leading to a Ph.D. in literature offers to qualified students the opportunity to develop individual courses of study with a strong emphasis on interdisciplinary work, literary theory, and cultural studies, while at the same time building strength in one or more of the national literatures. The program offers both introductory courses (the 250 series) and more specialized seminars (the 280 series), as well as tutorials (300) in specific research projects or problems.

For tutorials, advising, and dissertation supervision the program draws also on the expertise of other faculty such as Professor C. Davidson (English), Associate Professor Wharton (art); Professor Newton and Associate Professor Burian (classical studies); Professors Ryals, Sedgwick, and Torgovnick (English); Professor Tetel and Associate Professor Orr (French); Professor Borchardt (German); and Professor Lahusen (Slavic). Students entering the program must present evidence of ability to read one language other than English, and must acquire reading competence in a second language before taking their preliminary examinations.

More information on the program and a full descriptive brochure is available from Professor Surin, Director of Graduate Studies, Art Museum 104, Duke University, Durham, North Carolina 27708-0670.

**211. Theory and Practice of Literary Translation.** Linguistic foundations and historical role of translation. Practical exercises and translation assignments. Prerequisites: working knowledge of a foreign language and consent of instructor. 3 units. *Burian*

**212. Studies in Narrative.** Topics to vary. 3 units. *Staff*

**214. Gender, Nationalities, and Russian Literary Traditions.** See C-L: Russian 214; also C-L: Women's Studies. 3 units. *Gheith*



**251. History of Criticism.** A historical survey of critical and philosophical concepts affecting the definition and evaluation of literature from Plato through the nineteenth century. 3 units. *Hardt, Jameson, Lentricchia, or Stewart*

**252. Criticism and Literary Theory in the Twentieth Century.** Introduction to critical movements, philosophies, and strategies forming contemporary theories of literature: deconstruction, feminism, formalism, Marxism, New Criticism, phenomenology, psychoanalysis, structuralism. May be repeated for credit according to change of content or instructor. 3 units. *Jameson or Rolleston, with guest lecturers*

**253. Philology, Linguistics, and the Roots of Literature.** A survey of the various ways in which language and literature interact, with an introduction to philology and historical linguistics. 3 units. *Andrews (Slavic) or Thomas*

**254. Introduction to Feminism.** Major trends and tendencies of feminist theory and its history. Perspectives are both international as well as Third World and interdisciplinary. Various feminist methodologies as well as crucial polemics. 3 units. *Moi, Radway, or Schor*

*(The 280-290 series implies prior knowledge of literary theory, past and present; these courses are open to graduate students and qualified seniors only.)*

**280. Semiotics for Literature.** See C-L: French 223. 3 units. *Thomas*

**281. Paradigms of Modern Thought.** Specialized study of the work of individual thinkers who have modified our conceptions of human reality and social and cultural history, with special emphasis on the form and linguistic structures of their texts considered as "language experiments." Topics will vary from year to year, including: Marx and Freud; J.-P. Sartre; Walter Benjamin; etc. 3 units. *Jameson, Moi, Mudimbe, or Surin*

**282. Contemporary Literary Theory.** Specialized studies in literary theory from Saussurean linguistics to the present day (e.g., deconstruction, feminism, new historicism, neopragmatism, reception theory). 3 units. *Fish, Jameson, Lentricchia, or Tompkins*

**283. Modernism.** Aspects of the "modern," sometimes with emphasis on the formal analysis of specific literary and nonliterary texts (Joyce, Kafka, Mahler, Eisenstein); sometimes with a focus on theories of modernism (Adorno), or on the modernism/postmodernism debate, or on the sociological and technological dimensions of the modern in its relations to modernization, etc. 3 units. *Jameson or Lentricchia*

**284. The Intellectual as Writer.** History and theory of the literary role of the intellectual in society (e.g., in Augustan Rome, the late middle ages, the Renaissance, America, Latin America). 3 units. *Jameson, Lentricchia, Moi, Mudimbe, or Surin*

**285. Literature and Ideology.** The theoretical problem of the relationship between literature and ideology, explored through the cultural history of genres, major writers, or aesthetic movements. 3 units. *Jameson, Lentricchia, or Mudimbe*

**286. Topics in Legal Theory.** A consideration of those points at which literary and legal theory intersect (e.g., matters of intention, the sources of authority, the emergence of professional obligation). 3 units. *Fish*

**287. Problems in Narrative Analysis.** An introduction to contemporary theories and methods of narrative analysis (Greimas, Barthes, Hayden White, etc.), with emphasis on a specific area (e.g., historiography, film, sub-genres of the novel, myth, cognitive discourse). 3 units. *Jameson, Mudimbe, or Radway*

**288. Basic Issues in the History of Literary Theory.** Issues include attempts to define literature, divergent views of its social functions and psychological effects, and contem-



porary controversies regarding literary meaning and interpretation. Readings range from classic texts in philosophy of art to contemporary essays in critical theory. 3 units. *B. H. Smith or Stewart*

**289. Topics in Feminist Theory.** 3 units. *Moi, Radway, or Tompkins*

**290. Topics in Psychoanalytic Criticism.** 3 units. *Moi*

**291. Topics in Popular Culture and the Media.** 3 units. *Radway, Tompkins, or Willis*

**292. Topics in Non-Western Literature and Culture.** 3 units. *Mudimbe*

**293. Special Topics in Literature and History.** Relationship of literary texts to varieties of historical experience such as wars, periods of revolutionary upheaval, periods of intense economic growth, "times of troubles," or stagnation. Literary texts and historical content posed in such formal ways as the theoretical problem of the relationship between literary expression and form and a range of historical forces and phenomena. 3 units. *Jameson, Kaplan, Orr, or Schor*

**294. Theories of the Image.** Different methodological approaches to theories of the image (film, photography, painting, etc.), readings on a current issue or concept within the field of the image. Examples of approaches and topics are feminism, psychoanalysis, postmodernism, technology, spectatorship, national identity, authorship, genre, economics, and the ontology of sound. 3 units. *C. Davidson, Gaines, or Jameson*

**295. Representation in a Global Perspective.** Problems of representation approached in ways that cross and question the conventional boundaries between First and Third World. Interdisciplinary format, open to exploration of historical, philosophical, archeological, and anthropological texts as well as literary and visual forms of representation. 3 units. *Dorfman, Jameson, or Mignolo*

**296. Feminist Thought Before 1970.** Feminist thought developed before the emergence of the new women's movement; the historical and philosophical issues at stake in the feminist tradition. 3 units. *Moi*

**297. Topics in Cultural Studies.** 3 units. *Gaines, Radway, Surin, and staff*

**298. Topics in Philosophy and Literature.** Exploration of problems common to literary theory and philosophy. Examples of topics include: problems of identity, consciousness, foundationalism, interpretation, or ethics, or schools of thought such as pragmatism, phenomenology, and existentialism. 3 units. *Flanagan, Jameson, Mudimbe, and Surin*

**299. Universalism in Twentieth Century Thought.** The Enlightenment tradition and its critical reception in the twentieth century. Readings range from classic Enlightenment texts to contemporary texts. 3 units. *Staff*

**300. Problems in the Theory of Value and Judgment.** An advanced seminar dealing with classic problems relating to the concept of value and evaluative behavior (e.g., standards, judgments, canon-formation, taste), as illuminated by contemporary work in critical theory, anthropology, economics, sociology, etc. C-L: English 386 and Philosophy 300. 3 units. *B. H. Smith*

**301. Language and Theory in the Twentieth Century.** A seminar examining some of the most significant analyses, controversies, and achievements of the various disciplinary approaches to language during the past century and their implications for cultural study. Topics include the question of linguistics as a science, the muddle of meaning and interpretation, approaches to communication as social interaction, the Chomskian episode, and poststructural/postanalytic conceptions and contributions. 3 units. *Fish, B. H. Smith, and Tetel*

**302. Seminar in Emergent Literatures.** An advanced seminar in the literature of Third World or nonwestern countries. Specific topics vary from year to year. 3 units. *Dorfman*

**303. Topics in Criticism and Aesthetics.** Selected readings in traditional and contemporary criticism, philosophical aesthetics, and literary theory. 3 units. *Visiting faculty or staff*

**391. Tutorial in Special Topics.** Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units. *Staff*

**399. Special Readings.** Consent of instructor required. Variable credit. *Staff*

## The University Program in Marine Sciences

Professor Ramus (botany and environment), *Director*; Associate Professor Rittschof (zoology and environment), *Director of Graduate Studies*; Professors Barber (botany, environment, geology, and zoology), C. Bonaventura (cell biology and environment), J. Bonaventura (cell biology and environment), Forward (zoology and environment), Pilkey\* (geology), and Searles† (botany; Assistant Professors Howd (environment and geology) and Lozier (environment, geology, and mechanical engineering and materials science); Professor of the Practice Orbach (environment); Associate Professor of the Practice Kirby-Smith (environment)

Graduate students from any and all academic disciplines are encouraged to take training at the Marine Laboratory. The program operates year-round, providing course work in the marine sciences, an active seminar program, and facilities supporting dissertation research. Resident graduate students represent the Departments of Botany, Cell Biology, Environment, Geology, and Zoology. Ordinarily, dissertation advisors are resident as well, although this need not be the case. The Marine Laboratory has available graduate student instructional assistantships and fellowships during the academic year, including summer. In addition, tuition credits obtained from fellowship support may be applied to courses given both at the Marine Laboratory and the Durham campus.

Persons interested in graduate work in the marine sciences should apply through one of the appropriate departments (botany, cell biology, environment, geology, mechanical engineering, or zoology). The application form for enrollment in a graduate degree program may be obtained from the Graduate School. Graduate students planning to enroll in academic course work at the Marine Laboratory during the fall or spring semester should notify the Admissions Office of the Marine Laboratory of such intent at the time of preregistration for the respective semester and must register as normally prescribed. Students planning to enroll in academic course work or graded graduate research at the Marine Laboratory during the summer must submit the appropriate application form to the Admissions Office, Duke University, School of the Environment, Marine Laboratory, 135 Duke Marine Lab Road, Beaufort, North Carolina 28516-9721. The application form for enrollment in summer courses is found in the publication *Marine Laboratory 1995*. Students registering for graded research in the fall, spring, or summer should do so under the appropriate departmental numbers.

The following courses are offered at Beaufort. See the publication *Marine Laboratory 1995* for the current schedule of courses.

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\*Spring only.

†Summer only.



## FALL, SPRING, OR SUMMER PROGRAM AT BEAUFORT

### For Juniors, Seniors, and Graduates

**Botany 218L. Barrier Island Ecology.** An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Environment 218L. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

**Botany 359, 360. Research.** Individual investigation in the various fields of botany. Credit to be arranged. *All members of the Graduate School staff*

**Cell Biology 210. Individual Study.** Directed reading and research in cell biology/physiology. Prerequisite: consent of director of graduate studies. Credit to be arranged. *Staff*

**Cell Biology 235, 235L. Advanced Research Training in Marine Molecular Biology and Biotechnology.** Modern molecular biology is taught in lectures and laboratory exercises using fish, molluscs, algae, and marine forms. Topics and techniques include DNA, RNA, and protein assays; isolation; genomic library screening, and bacteriological and cell culture techniques. Given at Beaufort. C-L: Environment 254, 254L. 4 units; 6 units with laboratory. *Staff*

**Cell Biology 243. Environmental Biochemistry.** Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 243. C. *Bonaventura and Brouwer*

**Cell Biology 244L. Cellular and Molecular Research Techniques.** Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium assays, rapid reaction kinetics, microscopy, molecular graphics and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 244L. 4 units. C. *Bonaventura and Brouwer*

**Cell Biology 270S. Molecular and Cellular Adaptations of Marine Organisms.** Marine organisms meet the challenge of living in a hostile and ever-changing environment by numerous adaptive mechanisms. This seminar focuses on the underlying cellular and molecular processes. Topics explored in regard to adaptive processes in marine organisms include changes in metabolism, respiration, and vision. The impact of environmental pollutants and human health significance will also be addressed. C-L: Environment 224S. 2 units. C. *Bonaventura*

**Environment 218L. Barrier Island Ecology.** An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

**Environment 219L. Marine Ecology.** Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent projects. Topics include characteristics of marine habitats, adaptation to the environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. (Given at Beaufort.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. Four units (fall and spring; 6 units (summer). Variable credit. *Staff*

**Environment 222. Physical Processes in Coastal Environments.** The physical processes on beaches, the inner continental shelf, and in estuaries, in the context of their implications for the biological and geological environments. Topics to be drawn from the origin of waves and currents, tides, turbulence and mixing transport of sand and larvae. Applications to biomechanics and coastal erosion, and to marine ecology, coastal zone management, and water quality. (Given at Beaufort.) Prerequisites: Mathematics 31. and 32. C-L: Geology 201. 3 units. *Howd*

**Environment 223L. Behavioral Ecology.** How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. (Not open to undergraduates.) Prerequisite: introductory biology. 4 units. *Rubenstein (visiting summer faculty)*



**Environment 225L. Coastal Ecotoxicology and Pollution.** Principles of transport, fates, food-web dynamics and biological effects of pollutants in the marine environment. Laboratory to stress standard techniques for assessing pollutant levels and effects. Prerequisites: introductory chemistry and biology. (Given at Beaufort.) 4 units. *Staff*

**Environment 226L. Marine Mammals.** Ecology, social organization, behavior, acoustic communication, and management issues. Focused on marine mammals in the southeastern United States (for example, bottlenose dolphin, right whale, West Indian manatee). Laboratory exercises will consider social organization and acoustic communication in the local bottlenose dolphin population. (Given at Beaufort.) Suggested prerequisite: introductory biology. 2 units. *Forward and staff*

**Environment 228L. Physiology of Marine Animals.** Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Not open to undergraduates. (Given at Beaufort.) Prerequisites: introductory biology and chemistry. 4 units (fall); 6 units (summer). *Forward*

**Environment 229L. Biochemistry of Marine Animals.** Functional, structural, and evolutionary relationships of biochemical processes of importance to marine organisms. (Not open to undergraduates.) Prerequisites: introductory biology and inorganic chemistry. 4 units. *Rittschof*

**Environment 243. Environmental Biochemistry.** Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. Prerequisite: organic chemistry. C-L: Environment 243. 3 units. C. *Bonaventura and Brouwer*

**Environment 244. Cellular and Molecular Research Techniques.** Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium assays, rapid reaction kinetics, microscopy, molecular graphics and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. Prerequisite: organic chemistry. C-L: Environment 244. 3 units. C. *Bonaventura and Brouwer*

**Environment 252L. Statistics and Data Analysis in Earth and Ocean Science.** Techniques commonly used by earth and ocean scientists for the analysis of spatial and/or temporal series of data. Topics include regression, Fourier analysis, nonparametric spectral analysis, and, perhaps, principal components analysis and parametric spectral estimators. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32, Statistics 110 or 112, or consent of instructor. C-L: Geology 222L. 4 units. *Howd*

**Environment 256S. Seminar in Ocean Sciences.** Biological, chemical, physical, and geological aspects of the ocean and their relation to environmental issues. Consent of instructor required. (Given at Beaufort.) 3 units. *Orbach*

**Environment 273. Marine Fisheries Policy.** Principles, structure, and process of public policy-making for marine fisheries. Topics include local, regional, national, and international approaches to the management of marine fisheries. A social systems approach is used to analyze the biological, ecological, social, and economic aspects of the policy and management process. (Given at Beaufort.) 3 units. *Orbach*

**Environment 276. Marine Policy.** Formal study of policy and policy making concerning the coastal marine environment. History of specific marine-related organizations, legislation, and issues and their effects on local, regional, national, and international arenas. Topics explored through use of theoretical and methodological perspectives, including political science, sociology, and economics. (Given at Beaufort.) Consent of instructor required. C-L: Public Policy Studies 197. 3 units. *Orbach*

**Environment 290. Physical Oceanography.** Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics to be covered include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Prerequisite: laboratory calculus. C-L: Geology 203 and Mechanical Engineering 290. 3 units. *Lozier*

**Environment 291. Geological Oceanography.** The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 296S. (Given at Beaufort.) C-L Geology 205. 3 units. *Staff*

**Environment 292. Biological Oceanography.** Physical, chemical, and biological processes of the oceans, emphasizing special adaptation for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. (Not open to undergraduates.) Prerequisite: introductory biology. 4 units (fall or spring). *Ramus or staff*

**Environment 292L. Biological Oceanography.** Same as 292 with laboratory. 6 units (summer). *Ramus or staff*

**Environment 293. Analysis of Ocean Ecosystems.** Examination of the ecosystem concept considering its history, utility, and heuristic value. Examination of ocean systems in the context of Odum's ecosystem concept. Structure and function of the earth's major ecosystems. Term paper required. (Not open to undergraduates.) Prerequisites: one year of biology and chemistry, or consent of instructor. 3 units. *Barber*

**Environmental 294L. Marine Communities.** Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. (Not open to undergraduates.) Prerequisites: introductory biology and mathematics. 4 units. *Gerhart*

**Environment 295L. Marine Invertebrate Zoology.** Structure, function, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Biology or Zoology 274L. Not open to undergraduates. Prerequisite: introductory biology. 4 units (fall or spring); 6 units (summer). *Kirby-Smith*

**Environment 297L. Biology of Marine Invertebrates.** Systematic survey of the principal marine invertebrate taxa, with emphasis on structure, function, behavior, and ecology. Field trips and independent projects. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Zoology 274L. 6 units. *Dimock (visiting summer faculty)*

**Environment 298. The Oxygen Paradox: An Essential Environmental Pollutant.** Oxygen is essential for the survival of almost all eukaryotes. However, it is becoming increasingly clear the oxygen-derived free radicals contribute to the process of aging, the promotion of cancer and several pathological disorders. Hence, oxygen is essential for life, but it carries the risk of destroying the very life for which it serves as the source of useful energy. Focus on the chemistry, biology/physiology and toxicology of oxygen, consisting of lectures, and readings and reports/discussions of recently-published research papers. 2 units. *Brouwer*

**Environment 299. Independent Studies and Projects.** Directed readings or research at the graduate level to meet the needs of individual students. Consent of instructor required. Units to be arranged. *Staff*

**Environment 398.02. Seminar** intended to assist students in the production and presentation of their master's projects and in the development of professional skills related to coastal environmental management. Students present the results of their master's projects in a simulated professional forum; engage in a variety of written, verbal, and problem-solving exercises concerning coastal environmental issues; and discuss professional skills such as proposal writing, budgeting and fiscal planning, and mediation and consensus-building. 1 or 2 units. Variable credit. Pass/fail. *Orbach*

**Geology 205S. Geological Oceanography.** The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. C-L: Environment 291S. 3 units. *Staff*

**Geology 209. Climatic Change.** Record of changing climate on Earth, as determined from the analysis of deep sea sediments, ice-cores, lake sediments, and tree rings. C-L: Environment 231. 4 units. *Johnson*

**Geology 371, 372. Advanced Topics in Geology.** To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. 1 to 3 units. *Staff*

**Zoology 203L. Marine Ecology.** Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. Prerequisites: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Environment 219L. 6 units. *Gerhart*

**Zoology 274L. Biology of Marine Invertebrates.** Systematic survey of the principal marine invertebrate taxa, with emphasis on structure, function, behavior and ecology. Field trips and independent projects. Not open to undergraduates. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Environment 297L. 6 units. *Dimock (visiting summer faculty)*

**Zoology 353, 354. Research.** To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. *Staff*

**Zoology 360, 361. Tutorials.** An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. Hours and credit to be arranged. *Staff*

**Seminar.** Special topics in the ocean sciences. Exploration at the advanced level of current research in the ocean sciences. Subject dependent on faculty and student interests. Botany 295S, 296S; or Zoology 295S, 296S. 2 units. *Staff*



## COURSES CURRENTLY UNSCHEDULED

Botany 219L. Benthic Marine Algae

Botany 227L. Biology of Marine Macrophytes

Biochemistry 245L. Macromolecules, Ecology, and Evolution

Biochemistry 276. Comparative and Evolutionary Biochemistry

Biology 263L. Tropical Seaweeds

## Mathematics

Professor Schaeffer, *Chair* (132-B Physics); Professor Bryant, *Director of Graduate Studies* (135-C Physics); Professors Allard, Beale, Bryant, Hain, Harer, Lawler, Morrison, Pardon, Reed, Rose, Stern, Venakides, and Weisfeld; Associate Professors Burdick, Hodel, Kitchen, Kraines, Moore, Saper, Schoen, Scoville, Smith, Trangenstein, and Zhou; Assistant Professors Layton, Yang, and Zheng; Adjunct Professor Chandra

Graduate work in the Department of Mathematics is offered leading to the A.M. and Ph.D. degrees. Admission to these programs is based on the applicant's undergraduate academic record, level of preparation for graduate study, the Graduate Record Examination, and letters of recommendation.

All A.M. and Ph.D. candidates are required to pass a qualifying examination after completing their first year of graduate study. The A.M. degree with a major in mathematics is awarded upon completion of 30 units of graded course work and passing the qualifying examination. A thesis may be substituted for 6 units of course work only under special circumstances.

Soon after the student who is pursuing a Ph.D. degree passes the qualifying examination, the director of graduate studies appoints a committee of two graduate faculty members who determine the conditions to be met by the student before he or she takes the preliminary examination. Normally, this committee forms the nucleus of the student's advisory committee. The conditions may include a reading knowledge of one or more foreign languages appropriate to the student's intended area of specialization, an appropriate level of computer programming proficiency, or specific course work.

Candidacy for the Ph.D. is established by passing an oral preliminary examination. The preliminary examination is normally taken during the third year. The preliminary examination is conducted by a committee selected by the rules of the Graduate School and the department. The examination can, at the student's option, consist of questions based either on the student's course work at Duke or on the specific area of research plus a minor subject selected by the student.

After admission to candidacy, the Ph.D. degree is awarded on the basis of the student's scholarly ability as demonstrated by the dissertation and its defense. The dissertation is the most important requirement in the award of the Ph.D. degree.

### For Seniors and Graduates

**200. Introduction to Algebraic Structures I.** Laws of composition, groups, rings; isomorphism theorems; axiomatic treatment of natural numbers; polynomial rings; division and Euclidean algorithms. Not open to students who have had Mathematics 121. Prerequisite: Mathematics 104 or equivalent. 3 units. *Staff*

**201. Introduction to Algebraic Structures II.** Vector spaces, matrices and linear transformations, fields, extensions of fields, construction of real numbers. Prerequisites: Mathematics 200, or Mathematics 121 and consent of instructor. 3 units. *Staff*

**203. Basic Analysis I.** Topology of  $\mathbb{R}^n$ , continuous functions, uniform convergence, compactness, infinite series, theory of differentiation, and integration. Not open to students who have had Mathematics 139. Prerequisite: Mathematics 104. 3 units. *Staff*



**204. Basic Analysis II.** Inverse and implicit function theorems, differential forms, integrals on surfaces, Stokes' theorem. Not open to students who have had Mathematics 140. Prerequisites: Mathematics 203, or Mathematics 139 and consent of instructor. 3 units. *Staff*

**205. Topology.** Elementary topology, surfaces, covering spaces, Euler characteristic, fundamental group, homology theory, exact sequences. Prerequisite: Mathematics 104. 3 units. *Staff*

**206. Differential Geometry.** Geometry of curves and surfaces, the Serret-Frenet frame of a space curve, the Gauss curvature, Cadazzi-Mainardi equations, the Gauss-Bonnet formula. Prerequisite: Mathematics 104. 3 units. *Staff*

**221. Numerical Analysis.** Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 250; also C-L: Statistics 273. 3 units. *Greenside or Rose*

**222. Numerical Differential Equations.** Prerequisite: Computer Science 221 or 250. See C-L: Computer Science 252. 3 units. *Greenside or Rose*

**223. Numerical Linear Algebra.** Prerequisite: Computer Science 221 or 250 or equivalent. See C-L: Computer Science 254. 3 units. *Rose or Sun*

**230. Mathematical Methods in Physics and Engineering I.** Heat and wave equations, initial and boundary value problems, Fourier series, Fourier transforms, potential theory. Not open to students who have had Mathematics 114. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

**231. Mathematical Methods in Physics and Engineering II.** Green's functions, partial differential equations in several space dimensions. Complex variables, analytic functions, Cauchy's theorem, residues, contour integrals. Other topics may include method of characteristics, perturbation theory, calculus of variations, or stability of equilibria. Prerequisite: Mathematics 114 or 230. 3 units. *Staff*

**233. Asymptotic and Perturbation Methods.** Asymptotic solution of linear and nonlinear ordinary and partial differential equations. Asymptotic evaluation of integrals. Singular perturbation. Boundary layer theory. Multiple scale analysis. Prerequisite: Mathematics 114 or equivalent. 3 units. *Staff*

**238, 239. Topics in Applied Mathematics.** Conceptual basis of applied mathematics, combinatorics, graph theory, game theory, mathematical programming, or numerical solution of ordinary and partial differential equations. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units each. *Staff*

**240. Applied Stochastic Processes.** An introduction to stochastic processes without measure theory. Topics selected from: Markov chains in discrete and continuous time, queueing theory, branching processes, martingales, Brownian motion, stochastic calculus. Prerequisite: Mathematics 135 or equivalent. C-L: Statistics 253. 3 units. *Staff*

**241. Linear Models.** Prerequisites: Mathematics 104 and Statistics 113 or 210. See C-L: Statistics 244. 3 units. *Staff*

**242. Introduction to Multivariate Statistics.** Prerequisite: Statistics 244 or equivalent. See C-L: Statistics 245. 3 units. *Burdick*

**260. Groups, Rings, and Fields.** Groups including nilpotent and solvable groups, p-groups and Sylow theorems; rings and modules including classification of modules over a PID and applications to linear algebra; fields including extensions and Galois theory. Prerequisite: Mathematics 201 or equivalent. 3 units. *Staff*

**261. Commutative Algebra.** Extension and contraction of ideals, modules of fractions, primary decomposition, integral dependence, chain conditions, affine algebraic varieties, Dedekind domains, completions. Prerequisite: Mathematics 260 or equivalent. 3 units. *Staff*

**271. Algebraic Topology.** Fundamental group and covering spaces, homology groups of cell complexes, classification of compact surfaces, the cohomology ring and Poincaré duality for manifolds. Prerequisites: Mathematics 171S and 200 or equivalents. 3 units. *Staff*

**273. Algebraic Geometry.** Local theory: affine varieties, algebraic and topological theory of singularities. Global theory over the complex numbers: Riemann surfaces, Jacobians, Kähler manifolds, Hodge theory, theorems of Lefschetz and Kodaira. Prerequisite: Mathematics 261 or equivalent. 3 units. *Staff*

**275. Differential Geometry.** Differentiable manifolds, fiber bundles, connections, curvature, characteristic classes, Riemannian geometry including submanifolds and variations of the length integral, complex manifolds, homogeneous spaces. Prerequisites: Mathematics 204 and 260 or equivalents. 3 units. *Staff*

**276. Topics in Differential Geometry.** Lie groups and related topics, Hodge theory, index theory, minimal surfaces, Yang-Mills fields, exterior differential systems, several complex variables. Prerequisite: Mathematics 275 or consent of instructor. 3 units. *Staff*

**277. Topics in Algebraic Geometry.** Projective varieties and the theory of extremal rays, classification of surfaces and higher-dimensional varieties, variation of Hodge structure and moduli problems, schemes and arithmetic varieties, or other advanced topics. Prerequisite: Mathematics 273 or consent of instructor. 3 units. *Staff*

**278, 279. Topics in Topology.** Point set, algebraic, geometric, or differential topology. Consent of instructor required. 3 units each. *Staff*

**281. Real Analysis I.** Measures; Lebesgue integral;  $L^p$  spaces; Daniell integral, differentiation theory, product measures. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

**282. Real Analysis II.** Metric spaces, fixed point theorems, Baire category theorem, Banach spaces, fundamental theorems of functional analysis, Fourier transform. Prerequisite: Mathematics 281 or equivalent. 3 units. *Staff*

**285. Complex Analysis.** Complex calculus, conformal mapping, Riemann mapping theorem, Riemann surfaces. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

**286. Topics in Complex Analysis.** Geometric function theory, function algebras, several complex variables, uniformization, or analytic number theory. Prerequisite: Mathematics 285 or equivalent. 3 units. *Staff*

**290. Probability.** Random variables, independence, expectations, laws of large numbers, central limit theorem, Markoff chains. Prerequisite: Mathematics 281 or equivalent. C-L: Statistics 207. 3 units. *Staff*

**293. Topics in Probability Theory.** Brownian motion, diffusion processes, random walks, and applications to differential equations and mathematical physics. Prerequisite: Mathematics 290 or consent of instructor. C-L: Statistics 297. 3 units. *Staff*

**296. Ordinary Differential Equations.** Existence and uniqueness theorems for nonlinear systems, well-posedness, two-point boundary value problems, phase plane diagrams, stability, dynamical systems, and strange attractors. Prerequisites: Mathematics 104, 111 or 131, and 203 or 139. 3 units. *Staff*



**297. Partial Differential Equations I.** Fundamental solutions of linear partial differential equations, hyperbolic equations, characteristics, Cauchy-Kowalevski theorem, propagation of singularities. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

**298. Partial Differential Equations II.** Elliptic boundary value problems, regularity theorems, the diffusion equation, and nonlinear equations. Prerequisite: Mathematics 297 or equivalent. 3 units. *Staff*

**299. Topics in Partial Differential Equations.** Hyperbolic conservation laws, pseudo-differential operators, variational inequalities, theoretical continuum mechanics. Prerequisite: Mathematics 298 or equivalent. 3 units. *Staff*

**378-379. Current Research in Topology.** 6 units. *Staff*

**388, 389. Current Research in Analysis.** 3 units each. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**234. Mathematics for Quantum Mechanics**

**235. Topics in Mathematical Physics**

**245. Functional Analysis for Scientific Computing**

**250. Introductory Mathematical Logic**

**251. Set Theory I**

**252. Set Theory II**

**253. Recursion Theory**

**258, 259. Topics in Logic**

**268. Topics in Algebra**

**269. Topics in Algebra**

**280. Differential Analysis**

**283. Linear Operators**

**284. Topics in Functional Analysis**

**288, 289. Topics in Analysis**

**294. Topics in Probability Theory**

**295. Fourier Analysis and Distribution Theory**

**358-359. Current Research in Logic**

**368-369. Current Research in Algebra**

**387. Current Research in Mathematical Physics**

### **Program in Medieval and Renaissance Studies**

Professor Witt, *Chair*; Professor DeNeef, *Director of Graduate Studies* (127 Allen)

The graduate Program in Medieval and Renaissance Studies is an interdisciplinary program administered by the Duke University Center for Medieval and Renaissance Studies. In consultation with the director of graduate studies, students in the program select courses in art, history, music, philosophy, religion, language, and literature (classical studies,



English, German, and Romance languages). For descriptions of the individual courses see the listings under the specified department.

**200S. Seminar in Medieval and Renaissance Studies.** Topics in the historiography and interpretation of medieval and Renaissance culture. Topics will vary from year to year. 3 units. *Staff*

**300. Research Colloquium in Medieval and Renaissance Studies.** Credit only. 3 units. *Staff*

#### DEPARTMENT OF ART AND ART HISTORY

- 216. The Art of the Counter-Reformation. *Rice*
- 233S. Topics in Early Christian and Byzantine Art. *Wharton*
- 236S. Topics in Romanesque and Gothic Art and Architecture. *Staff*
- 243S. Topics in Netherlandish and German Art. *Van Miegroet*
- 247S. Topics in Italian Renaissance Art. *Rice*
- 260S. Topics in Italian Baroque Art. *Rice*

#### DEPARTMENT OF CLASSICAL STUDIES

- 221. Medieval Latin. *Newton*
- 312. Seminar in Latin Paleography. *Newton*

#### DEPARTMENT OF ENGLISH

- 207A. Introduction to Old English. *Staff*
- 207B. Old English Literature. *Staff*
- 208. History of the English Language. *Butters or Tetel*
- 212. Middle English Literature: 1100 to 1500. *Staff*
- 213, 214. Chaucer. *Staff*
- 221. Renaissance Prose and Poetry: 1500 to 1660. *DeNeef, Fish, Randall, or Schwartz*
- 225. Renaissance Drama: 1500 to 1642. *Randall*
- 310. Studies in Old English Literature. *Staff*
- 312. Studies in Middle English Literature. *Staff*
- 315. Studies in Chaucer. *Fish*
- 321. Studies in Renaissance Literature. *DeNeef, Fish, Porter, Randall, or Schwartz*
- 324. Studies in Shakespeare. *Porter*
- 329. Studies in Milton. *DeNeef, Fish, or Schwartz*

#### DEPARTMENT OF GERMANIC LANGUAGES AND LITERATURE

- 201. Introduction to Middle High German. *Rasmussen*
- 202S. Medieval Seminar. *Rasmussen*
- 203S. Sex, Gender, and Love in Middle High German Literature. *Rasmussen*
- 210S. Renaissance and Reformation. *Borchardt*
- 260. History of the German Language. *Rasmussen*

#### DEPARTMENT OF HISTORY

- 221. Topics in the Social and Economic History of Europe, 1200-1700. *Staff*
- 222. Problems in the Intellectual History of the European Renaissance and Reformation. *Witt*
- 237S. Europe in the Early Middle Ages. *Staff*
- 238S. Europe in the High Middle Ages. *Staff*
- 251A. Topics in Intellectual History of Europe, 1250-1450. *Witt*
- 251B. Topics in Intellectual History of Europe, 1450-1650. *Witt*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*

#### DEPARTMENT OF MUSIC

- 211. Notation. *Williams*
- 222. Music in the Middle Ages. *Brothers*
- 223. Music in the Renaissance. *Brothers or Silbiger*
- 228-229. Collegium Musicum. *Brothers and Meniker*
- 317S. Seminar in the History of Music. (Topics vary.) *Staff*

#### DEPARTMENT OF PHILOSOPHY

- 218S. Medieval Philosophy. *Mahoney*
- 219S. Late Medieval and Renaissance Philosophy. *Mahoney*

#### DEPARTMENT OF RELIGION

- 206. The Christian Mystical Tradition in the Medieval Centuries. *Keefe*
- 219. Augustine. *Clark*
- 236. Luther and the Reformation in Germany. *Steinmetz*
- 250. Women in the Medieval Church. *Keefe*

- 272. The Early Medieval Church. *Keefe*
- 337. Theology of St. Thomas Aquinas. *Steinmetz*
- 338. Calvin and the Reformed Tradition. *Steinmetz*
- 339. The Radical Reformation. *Steinmetz*

## DEPARTMENT OF ROMANCE STUDIES

### French

- 211. History of the French Language. *Thomas*
- 248. French Literature of the Seventeenth Century. *Farrell*
- 325. French Prose of the Sixteenth Century. *Tetel*
- 326. Topics in Renaissance Poetry. *Tetel*
- 391, 392. French Seminar (medieval and Renaissance topics). *Tetel and staff*

### Italian

- 284, 285. Dante. *Caserta*

### Spanish

- 210. History of the Spanish Language. *Garci-Gómez*
- 341. Colonial Prose of Spanish America. *Ross*
- 342. Colonial Poetry and Theater of Spanish America. *Ross*
- 351. The Origin of Spanish Prose Fiction. *Staff*
- 353. Cervantes. *Staff*
- 358. Spanish Lyric Poetry before 1700. *Staff*
- 391, 392. Hispanic Seminar (medieval and Renaissance topics). *Staff*

## COURSES CURRENTLY UNSCHEDULED

- Classical Studies 327. Seminar in Byzantine History
- English 383. Studies in Textual Criticism
- French 240. Old French Literature
- German 215S. German Baroque Literature
- Music 341S. History of Music Theory to Rameau
- Music 351S. Studies in Musical Iconography
- Music 361S. Musical Organology
- Religion 241. Problems in Reformation Theology
- Religion 251. Counter-Reformation and Development of Catholic Dogma
- Religion 334. Theology and Reform in the Later Middle Ages
- Religion 344. Zwingli and the Origins of Reformed Theology

## Microbiology

Professor Keene, *Chair* (414A Jones); Associate Professor Pickup, *Director of Graduate Studies* (421 Jones); Professors Bastia, Bolognesi, Cullen, Endow, Joklik, Linney, and Nevins; Associate Professors Cullen, Kreuzer, Linney, Mitchell, and White; Assistant Professors Garcia-Blanco, Horowitz, Ostrowski, Seldin, and Wharton; Professors Emeriti Osterhout, Wheat, and Willett; Associate Research Professors Burdett, Harrell, and Miller

The Department of Microbiology offers a broadly-based graduate program leading to the Ph.D. degree. It also participates in interdepartmental programs such as the University Program in Genetics, the Program in Cell and Molecular Biology, and the Medical Scientist Training Program. The department's graduate program is designed to provide students with a strong scientific base in the principles and techniques of contemporary bacterial and animal cell biology.

The research interests of the faculty provide numerous and diverse areas for training in prokaryotic and eukaryotic molecular cell biology, molecular genetics and virology, as well as in broad multidisciplinary areas like the nature of protein nucleic acid interactions, the nature of the molecular controls of gene expression, molecular virology, and the function of oncogenes and antioncogenes.

Undergraduate preparation in the biological and physical sciences and in biochemistry is required. A brochure describing the Ph.D. degree program, prerequisites for admission, and research in the department may be obtained by writing the Director of Graduate Studies, Box 3020, Duke University Medical Center, Durham, North Carolina 27710.

**214. Fundamentals of Electron Microscopy.** Introduction to the basics of transmission electron microscopy. Specimen preparation techniques include: grid preparation, negative staining, metal shadowing, nucleic acid spreading, embedding, and thin sectioning. Students gain experience in the use of the ultramicrotome and electron microscope by working on their own projects. Additional techniques included are ultracryotomy immunoelectron microscopy, freeze-fracture, scanning electron microscopy, and X-ray spectroscopy. C-L: Immunology 214. 3 units. *Miller*

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Biochemistry 219, Immunology 219, and Pathology 219. 3 units. *Counce and staff*

**221. Medical Microbiology.** An intensive study of common bacteria, viruses, fungi, and parasites which cause disease in humans. The didactic portion of the course focuses on the nature and biological properties of microorganisms causing disease, the manner of their multiplication, and their interaction with the entire host as well as specific organs and cells. 4 units. *Mitchell and staff*

**246S. Parasitic Diseases.** Prerequisites: Biochemistry 227 or equivalent; and Immunology 244 or Immunology/Microbiology 291. See C-L: Immunology 246S. 3 units. *Balber*

**252. General Virology and Viral Oncology.** The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with retroviruses and transformation, which are discussed in terms of the virus-cell interaction, the relationship of viruses and oncogenes to neoplasia, and the role of the immunological response in retrovirus infections. Consent of instructor required. C-L: Immunology 252. 4 units. *Keene and staff*

**259. Molecular Biology I: Proteins and Enzymes.** Prerequisites: biochemistry, organic chemistry, and physical chemistry. See C-L: Biochemistry 259; also C-L: Cell Biology 259, Immunology 259, and Molecular Biophysics 259. 3 units. *Fierke and staff*

**268. Molecular Biology II: Nucleic Acids.** Prerequisites: introductory biochemistry and equivalents of Biochemistry 259 and Cell and Molecular Biology 247, 277, and 278. See C-L: Biochemistry 268; also C-L: Cell Biology 268, Immunology 268, and The University Program in Genetics 268. 4 units. *Steege and staff*

**291. Comprehensive Immunology.** See C-L: Immunology 291. 4 units. *Krangel and staff*

## **For Graduates**

**310. Molecular Development.** Selected topics of current research using molecular and genetic approaches to study development and developmental gene regulation. Focus on mammalian development using the mouse, mouse embryonic stem(ES) cells, and mouse teratocarcinoma cells as models. Lectures and student presentations of research on subjects including differential gene regulation, mouse embryos and oocytes, transgenic mice, maternal imprinting, embryonic stem(ES) cells, immune system development, gene mapping, and regulatory gene families. C-L: Immunology 310. 2 units. *Linney*

**325. Medical Mycology.** Comprehensive lecture and laboratory coverage of all the fungi pathogenic for humans. Practical aspects as well as future trends in the mycology, immunology, diagnosis, pathogenesis, and epidemiology of each mycotic agent will be explored. There will be several invited lecturers, each an internationally recognized scientist, discussing his or her particular area of mycological expertise and current research. Consent of instructor required. 4 units. *Mitchell*



**331. Microbiology Colloquium.** Current topics in microbiology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in microbiology. 1 unit. *White*

#### **COURSES CURRENTLY UNSCHEDULED**

**282. Molecular Microbiology**

**304. Molecular Membrane Biology**

**323. Topics in Cell and Molecular Biology**

**324. Topics in Molecular Genetics**

### **The University Program in Molecular Biophysics**

Professor D. Richardson, *Director* (biochemistry); Associate Professor White, *Director of Graduate Studies* (microbiology); Professors Erickson (cell biology), Hammes (biochemistry); McGown (chemistry), McIntosh (cell biology), Reedy (cell biology), J. Richardson (biochemistry), Shaw (chemistry), Simon (neurobiology), and Spicer (biochemistry); Associate Professors Corless (cell biology), Henkens (chemistry), and Hsieh (biochemistry); Assistant Professors Beese (biochemistry), Fierke (biochemistry), Hellinga (biochemistry), Oas (biochemistry), Prisant (chemistry), Salvesen (pathology), Toone (chemistry), and Van Dongen (pharmacology); Associate Medical Research Professor Taylor (cell biology)

The program in structural molecular biophysics at Duke centers on those research endeavors that use physical measurements to study biological macromolecules and their interactions, where the details of molecular structure are critical to understanding the biological problem in question. The focus is on understanding molecular structure/function at atomic resolution; the breadth extends to detecting molecular events and describing structural relationships in a chemically meaningful way, and relating atomic-level with higher-order structures. There is a commonality in the intellectual approaches and experimental techniques. Research problems addressed within the University Program in Molecular Biophysics include: 3-D structure determination by crystallography and NMR; molecular assemblies studied by various diffraction, spectroscopy, and microscopy techniques; protein folding; molecular modeling and design studies and their direct experimental testing; and functional studies in biochemistry, genetic mechanisms, drug interactions, membrane systems, and so on, for which the details of molecular geometry are central to interpreting the experiments.

Participating students may receive a certificate from the Molecular Biophysics Program in addition to the doctoral degree for their department. Requirements for the certificate ordinarily will include the core courses (Proteins and Enzymes, Physical Biochemistry I, Physical Biochemistry II, Structure of Biological Macromolecules, Membrane Biophysics), lab rotations with molecular biophysics faculty, giving and attending seminars, and an appropriate thesis topic and committee. However, the curriculum can be tailored for students with special interests and backgrounds. For further information about the University Program in Molecular Biophysics, contact the program office at Duke University, Box 3567 RCMR, Durham, North Carolina 27710; mbp@suna.biochem.duke.edu.

**222. Structure of Biological Macromolecules.** See C-L: Biochemistry 222. 2 units. *Richardson*

**259. Molecular Biology I: Proteins and Enzymes.** Prerequisites: biochemistry, organic chemistry, and physical chemistry. See C-L: Biochemistry 259; also C-L: Cell Biology 259, Immunology 259, and Microbiology 259. 3 units. *Fierke and staff*

**291. Physical Biochemistry.** Prerequisites: undergraduate physical chemistry and one year of calculus. See C-L: Biochemistry 291. 3 units. *Oas and staff*

**292. Physical Biochemistry II.** Transient kinetics, computational methods, multidimensional NMR, X-ray crystallography, thermodynamics of association. Prerequisite: Biochemistry 291 or Molecular Biophysics 291 or consent of instructor. 3 units. *Toone and staff*

**293. Membrane Biophysics.** Composition of biological membranes, structure/properties of membrane lipids and proteins (receptors, pores, channels, ion transport ATPases, membrane junctions), mechanical properties of membranes and bilayers, interaction of small molecules with membranes, ionic basis of membrane and action potentials, synaptic transmission. C-L: Cell Biology 293. 3 units. *McIntosh and staff*

**345, 346. Molecular Biophysics Seminar.** Required of all MBP students. 1 unit each. *Oas*

## Molecular Cancer Biology

Professor Means, *Director* (pharmacology); Professor Bennett (cell biology), *Director of Graduate Studies* (365 CARL Building); Professors Blackshear (medicine and biochemistry), Caron (cell biology), Dawson (immunology), Keene (microbiology), Lefkowitz (medicine and biochemistry), Modrich (biochemistry), Nevins (Genetics), and Sheetz (cell biology); Associate Professors Hannun (medicine and cell biology), Kaufman (medicine and biochemistry), and Shenolikar (pharmacology); Assistant Professors Casey (biochemistry), Garcia-Blanco (molecular cancer biology), Horowitz (molecular cancer biology), Kornbluth (molecular cancer biology), Lew (molecular cancer biology), Pendergast (pharmacology), Swenson (molecular cancer biology), and Wang (pharmacology)

The Program in Molecular Cancer Biology facilitates graduate training in basic science aspects of cancer research. Specifically, program students receive training in areas of normal cell regulation including extracellular signals, receptor-mediated signal transduction, second messengers, protein kinases and phosphatases, transcriptional regulation and cell-cycle control. Aspects of cell-cell interaction and communication and the interaction of cells with the extracellular matrix are also examined. Finally, the program explores the consequences of oncogene activation and tumor-suppressor gene inactivation on such fundamental processes in tumor cells.

The graduate Program in Molecular Cancer Biology is an interdisciplinary program administered by the Department of Molecular Cancer Biology at Duke University Medical Center. Program faculty have primary graduate appointments within one of seven basic science medical center departments. In consultation with the director of graduate studies, students in the program select courses in cell biology, molecular biology, immunology, cancer biology, pharmacology, and developmental biology. For descriptions of the individual courses see the listings under specified departments.

**200. Cancer Biology.** A comprehensive course in basic and clinical aspects of cancer biology. Topics include a historical review of cancer research, properties of cultured mammalian cells, cell transformation and tumorigenesis, oncogenes and tumor-suppressor genes, cell-cycle regulation, signal transduction, molecular carcinogenesis, cancer epidemiology, and basic science aspects of clinical oncology. 4 units. *Staff*

**300. Special Topics in Cancer Biology.** 2 units. *Staff*

**301. Molecular Cancer Biology Seminar.** 1 unit. *Staff*



## COURSES WITH MOLECULAR CANCER BIOLOGY CONTENT OFFERED BY PARTICIPATING DEPARTMENTS

### Cell Biology

- 219. Molecular and Cellular Bases of Differentiation. *Counce and staff*
- 232. Extracellular Matrix and Cell Adhesion. *Bennett and Erickson*
- 251. Molecular Cell Biology. *Erickson and staff*
- 269. Advanced Cell Biology. *Nicklas and staff*
- 417. Cellular Signaling. *Bell, Caron, Casey, Means, and invited lecturers*

### Biochemistry

- 215. Genetic Mechanisms. *Webster and staff*
- 259. Molecular Biology I: Proteins and Enzymes. *Richardson and staff*
- 268. Molecular Biology II: Nucleic Acids. *Steege and staff*

### Immunology

- 244. Principles of Immunology. *Kostyu, McClay, and staff*

### Microbiology

- 252. General Virology and Viral Oncology. *Keene and staff*
- 310. Molecular Development. *Linney*

### Pharmacology

- 233. Essentials of Pharmacology. *Slotkin and staff*
- 254. Mammalian Toxicology. *Abou-Donia and staff*

## Music

Associate Professor Jaffe, *Chair* (105 Mary Duke Biddle Music Building); Professor Todd, *Director of Graduate Studies* (079 Mary Duke Biddle Music Building); Professors Silbiger and Williams; Associate Professors Bartlet and Gilliam; Assistant Professors Brothers and Lindroth; Associate Professor of the Practice Parkins; Adjunct Assistant Professor Druesedow; Lecturer Meniker

The Department of Music offers graduate programs leading to the A.M. and Ph.D. degrees in composition, musicology, and performance practice. Students are encouraged to include work outside their main area of concentration within the department. In addition, each of the programs requires course work outside the department.

Applicants for admission to all degree programs will normally have a broad liberal arts background as well as demonstrable musical competence. Those applying to the composition program should submit samples of their compositions with their applications; for the musicology program, applicants should include samples of their writing on musical topics. Upon acceptance to the university, by nomination of the graduate faculty in music, musicology students may also be admitted to the Program in Medieval and Renaissance Studies (see section on Medieval and Renaissance Studies in this bulletin). For the performance practice program, the department encourages applications from advanced musicians who have demonstrated an ability to conduct research about the performance of music in historical contexts. Applicants in performance practice should submit a recording of their work in the field as well as a sample of their writing.

A reading knowledge of one foreign language is required for the A.M. degree and for the Ph.D. in composition; for the Ph.D. degree in performance practice and musicology two languages are required (one of these will normally be German). For some dissertation topics a third language may be required.

A detailed description of the requirements for the A.M. and Ph.D. is available upon request from the director of graduate studies.

**201. Introduction to Musicology.** Methods of research on music and its history, including studies of musical and literary sources, iconography, performance practice, ethnomusicology, and historical analysis, with special attention to the interrelationships of these approaches. 3 units. *Druesedow*



**203. Proseminar in Performance Practice.** Critical methods in the study of historical performance practice, including the evaluation of evidence provided by musical and theoretical sources, archival and iconographic materials, instruments, and sound recordings. Current issues regarding the performance practice for music from the Middle Ages to the twentieth century. 3 units. *Meniker or Silbiger*

**211, 212. Notation.** Development and changing function of musical notation from c. 900 to c. 1900, including plainchant notations, black notations, white notations, the invention of printing (particularly movable type and engraving), keyboard and lute tablatures, scores. 3 units each. *Brothers or Williams*

**213. Theories and Notation of Contemporary Music.** The diverse languages of contemporary music and their roots in the early twentieth century, with emphasis on the problems and continuity of musical language. Recent composers and their stylistic progenitors: for example Ligeti, Bartók, and Berg; Carter, Schoenberg, Ives, and Copland; Crumb, Messiaen, and Webern; Cage, Varèse, Cowell, and Stockhausen. 3 units. *Jaffe or Lindroth*

**215. Music Analysis.** Historical, philosophical, and ideological issues raised by music analysis. Intensive study of harmony and voice leading in the works of major tonal composers, with emphasis on the analytic approach of Heinrich Schenker. 3 units. *Silbiger or Todd*

**217. Selected Topics in Analysis.** An exploration of analytical approaches appropriate to a diversity of music, which may include settings of literary texts, pre-tonal music, and music in oral and vernacular traditions. Prerequisite: Music 215 or consent of instructor. 3 units. *Silbiger*

**218. Advanced Counterpoint.** Selected topics in modal or tonal contrapuntal practice with emphasis on music writing up to five parts. Consent of instructor required for students not registered for doctoral work in composition. 3 units. *Jaffe, Lindroth, or Williams*

*Courses dealing with selected topics in the period concerned, at a level between simple surveys and advanced seminars:*

**222. Music in the Middle Ages.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Brothers*

**223. Music in the Renaissance.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Brothers or Silbiger*

**224. Music in the Baroque Era.** Selected topics. 3 units. *Meniker, Silbiger, or Williams*

**225. Music in the Classic Era.** Selected topics. 3 units. *Bartlet or Todd*

**226. Music in the Nineteenth Century.** Selected topics. 3 units. *Bartlet, Gilliam, or Todd*

**227. Music in the Twentieth Century.** Selected topics. 3 units. *Gilliam or Todd*

**228-229. Collegium Musicum.** An opportunity to study and perform vocal and instrumental music from the Middle Ages to the early romantic period. Weekly rehearsals and one or two concerts each semester. A written project required of all participants. Consent of instructor required for all except graduate students in music. C-L: Medieval and Renaissance Studies. 3 units. *Meniker*

**228A-229A. Collegium Musicum.** Same as 228-229, but no project required and no credit awarded. C-L: Medieval and Renaissance Studies. No credit. *Meniker*

**230. Workshop in Performance Practice.** Laboratory for application of historically informed performance practice on instruments appropriate to the period of the music studied. Emphasizes instrumental and vocal chamber music. Open to graduates and undergraduates with consent of instructor. No credit. *Meniker*

**236. Nineteenth-Century Piano Music.** Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Liszt, and Brahms. The arts of improvisation and transcription, the keyboard virtuoso, the character piece, and the conflict between romantic content and form. 3 units. *Todd*

**295S. Composition Seminar.** Selected topics in composition. 3 units. *Jaffe or Lindroth*

**296S. Analysis of Contemporary Music.** Structures, expressive intentions, and functions since 1914. Contemporary orchestral music, American music, European music, popular media, musical tradition, and contemporary composers. Analysis of works performed in the department's Encounters Series with occasional guest composers present. 3 units. *Jaffe or Lindroth*

**297, 298, 299. Composition.** Weekly independent study sessions at an advanced level with a member of the graduate faculty in composition. 3 units each. *Jaffe or Lindroth*

**317S. Seminar in the History of Music.** Selected topics. 3 units. *Staff*

**318S. Seminar in Performance Practice.** A practical seminar in which participants will be expected to perform, to introduce the work to be played or sung, and to outline its interpretative problems. A list of the music concerned will be posted in advance, and all students will participate in the study (if not necessarily in the performance) of the works announced. It is expected that the seminar will cover most periods, from Gregorian chant to twentieth-century repertoires. Consent of instructor required. 3 units. *Williams*

**331, 332, 333. Independent Study in Performance Practice and Interpretation.** The exploration of significant interpretive and performance-practice issues as they affect a specific repertory. Weekly meetings with a member of the graduate faculty. Consent of instructor and director of graduate studies required. 3 units each. *Staff*

**390. Independent Study.** With the consent of a graduate faculty member and the approval of the director of graduate studies, the student will undertake a specialized research project of his/her own choosing. 3 units. *Staff*

**397, 398, 399. Composition.** Weekly independent studies at the doctoral level with a member of the graduate faculty in composition. 3 units each. *Jaffe or Lindroth*

#### **COURSES CURRENTLY UNSCHEDULED**

**341S. History of Music Theory to Rameau**

**351S. Studies in Musical Iconography**

**361S. Musical Organology**

**382S. Studies in Ethnomusicology**

## **Neurobiology**

Professor Purves, *Chair* (101I Bryan Research Building); Associate Professor Matthew, *Director of Graduate Studies* (301E Bryan Research Building); Professors Abou-Donia, Erickson, Flanagan, W. C. Hall, W. G. Hall, McClay, McNamara, Nadler, Roses, Simon, Slotkin, Somjen, Staddon, Strittmatter, Tyrey, and Warner; Associate Professors Augustine, Boustany, Cant, Casseday, Corless, Fitzpatrick, Katz, Lewis, Madison, Nowicki, Schmechel, Schwartz, Strittmatter, Tyrey, and Warner; Assistant Professors Freneau,



Hosford, Kauer, LaMantia, Lo, Mooney, Nicolelis, and Reinhart; Professors Emeriti Diamond, Moore, and Robertson; Assistant Research Professors Covey and Einstein

At a time when many questions in biology have been eloquently answered, both scientists and the public correctly perceive that the brain remains, in fundamental ways, a profound mystery. During the last century tremendous advances have been made in understanding the structure, function, chemistry, and development of the brain. Nonetheless, broad and important questions about this complex organ remain to be answered in both biology and medicine. These include how genetic instructions are linked to brain development, the basis of learning and memory, the nature of consciousness, and the etiology and proper treatment of neurological diseases such as epilepsy and Alzheimer's disease.

The ways that neurobiologists approach these problems, while generally reductionist, are diverse. Preeminent are the techniques of molecular biology and molecular genetics, a host of sophisticated electrophysiological methods for detecting the activity of individual nerve cells or groups of nerve cells, and a wealth of anatomical methods for seeing the structure and connections of nerve cells. Novel and increasingly noninvasive means of imaging the nervous system—by nuclear magnetic resonance, detection of positron emission, or activity related magnetic fields—also hold great promise for better understanding the brain. Despite the power of these methods, progress in neurobiology—much as progress in any science—will depend on a few important insights arising from the imagination of neuroscientists who think deeply about these issues. The purpose of the graduate program in neurobiology is to enable talented students to think about the nervous system at this level.

Neuroscientists at Duke work with the conviction that advances in understanding the brain will come from the application of a wide range of approaches and techniques. Thus, neurobiology at Duke is pursued in a variety of departments and settings, all of which are possible sites for students who wish to be trained in this field. Although much of this research is carried out in the Department of Neurobiology at Duke University Medical Center, several departments on the undergraduate campus also participate in this work. There are now 46 faculty members associated with the graduate program in neurobiology at Duke, and a large and diverse body of students and other professionals engaged in neurobiological research.

Students in the graduate program in neurobiology take a core curriculum that covers the major subfields of contemporary neurobiology, but are generally free to pursue—with the help of faculty advisors—a course of study tailored to their needs, backgrounds, and individual interests. The core courses in the Department of Neurobiology are 208, Cellular Neurobiology; 209, Systems Neurobiology; and 211, Developmental Neurobiology.

**202. Basic Neurobiology.** A systematic introduction to the structure and function of the mammalian nervous system designed specifically for first-year medical students. Lectures, laboratory exercises, clinical presentations, and problem-solving conferences during the month of January. 4 units. *Purves and staff*

**208. Cellular Neurobiology.** (Graduate Core Course.) Basic principles of neural electrical activity. Areas of emphasis will include action potential generation, ion channel structure/function relationships, modulation of channel activity, neurotransmitter secretion, transmitter receptors and mechanisms of synaptic plasticity. Consent of instructor required. Spring. C-L: Cell Biology 208. 3 units. *Augustine, Kauer, Lo, and Reinhart*

**209. Systems Neurobiology.** (Graduate Core Course.) Structure and function of the mammalian sensory and motor systems. Consent of instructor required. Fall. 3 units. *Cant, Fitzpatrick, Nicolelis, and Purves*



**210. Individual Study.** Directed reading and research in neurobiology. Consent of director of graduate studies required. 3 to 9 units each. Variable credit. *Staff*

**211. Developmental Neurobiology.** (Graduate Core Course.) The development of the nervous system covering both the history and present status of the major issues in this field. Consent of instructor required. Fall. 3 units. *Katz, LaMantia, Matthew, and Skene*

**280. Student Seminar.** Preparation and presentation of seminars to students and faculty on topics of broad interest in neurobiology. Required of all first- and second-year neurobiology students. 1 unit. *Augustine and Katz*

**312. Advanced Topics in Neurobiology.** Journal club format covering a variety of topics in neurobiology, e.g., sensory transduction, neurobiology of disease. Focus on critical reading of the literature. Consent of instructor required. 1 unit. *Staff*

**360. Neuropharmacology.** Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Consent of instructor required. C-L: Pharmacology 360. 3 units. *Fremeau*

**364. Neurotoxicology.** See C-L: Pharmacology 364. 3 units. *Abou-Donia and staff*

**372. Research in Neurobiology.** Laboratory research in various areas of neurobiology. Credit to be arranged. Variable credit. *Staff*

## COURSES CURRENTLY UNSCHEDULED

### 212. Molecular Neurobiology

## Pathology

Professor Pizzo, *Chair* (301B Davison); Assistant Professor Salvesen, *Director of Graduate Studies* (207 Jones); Professors Adams, D. Bigner, S. Bigner, Bossen, Bradford, Graham, Jennings, Johnston, Klintworth, Reimer, Shelburne, Sommer, and Wittels; Associate Professors Crapo, Greenberg, Hoffman, Kane, Proia, Reimer, and Zwadyk; Assistant Professors DeCamp, Dewhurst, Enghild, Friedman, Jirtle, Kurtzberg, Lewis, Schold, and Zalutsky; Associate Research Professor Wikstrand; Assistant Clinical Professor Vollmer; Adjunct Associate Professor Swenberg

The Department of Pathology offers graduate work leading to the Ph.D. degree with areas of specialization such as subcellular and molecular pathology. Course work is designed to give a broad background in classical and modern pathology with emphasis on the application of modern research techniques. Students will be required to take such courses as are necessary to obtain a broad foundation, as well as courses applicable to areas of specialty and research. Further information including brochures giving details of departmental facilities, staff, trainee stipends, and the M.D.-Ph.D. program are available from the director of graduate studies.

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Biochemistry 219, Immunology 219, and Microbiology 219. 3 units. *Counce and staff*

**250. General Pathology.** Presentation of the fundamentals of pathology. Senior staff members give lectures developing broad concepts of disease processes. Emphasis is on etiology and pathogenesis of disease. Prerequisites: histology and consent of instructor. 4 units. *Steenbergen and staff*

**251. Laboratory Course in General Pathology.** Laboratory session to complement Pathology 250. Gross and microscopic material is correlated with and related to disease

processes. Pathology 250 may be taken concurrently. Prerequisites: histology and consent of instructor. 4 units. *Steenbergen or staff*

**258. Cellular and Subcellular Pathology.** This course is designed for students wishing to broaden their knowledge of cellular structure and cellular pathology, and consists of lectures and seminars discussing the alterations in cellular structure and associated functions that accompany cell injury. Consent of instructor required. Hours to be arranged. 2 units. *Shelburne and Sommer*

**275. Fundamentals of Electron Microscopy and Biological Microanalysis.** Emphasis will be placed on preparative procedures including freezing techniques and on the application of electron microscopy to ultrastructural pathology. Scanning electron microscopy, X-ray microanalysis, and scanning ion microscopy will be discussed in addition to conventional transmission electron microscopy. Limited laboratory experience included. 3 units. *Ingram, Shelburne, and Sommer*

**325. Cardiovascular Pathology.** Study of cardiovascular disease processes, reviewing anatomic, embryologic, and physiologic features, and utilizing case material and gross specimens. Consideration of principles of electrocardiography. Consent of instructor required. 3 units. *Reimer and staff*

**353. Advanced Neuropathology.** Current problems and research methods related to diseases which affect the nervous system. Consent of instructor required. 3 units. *Graham and staff*

**355. Graduate Seminar in Pathology.** Discussions outlining the scope of modern pathology. This will include reports of original researchers by members of staff and visitors. 1 unit. *Salvesen*

**357. Research in Pathology.** Independent research projects in various fields of pathology. Hours and credit to be arranged. Variable credit. *Graduate faculty*

**361, 362. Autopsy Pathology.** A detailed consideration of the morphologic, physiologic, and biochemical manifestations of disease. Emphasis is on individual work in the laboratory with tutorial supervision. Gross dissection; histologic examination; processing; analysis of morphologic, microbiologic, and biochemical data; and interpretation of results. For advanced students. 3 to 6 units each. Prerequisites: Pathology 250 and consent of instructor. Variable credit. *Proia and staff*

**364. Systemic Pathology.** Systematic presentation of the characteristics of disease processes as they affect specific organ systems. Consent of instructor required. 6 units. *Staff*

**367. Special Topics in Pathology.** Special problems in pathology will be studied with a member of the senior staff; the subject matter will be individually arranged. Hours to be arranged. 2 to 4 units. Variable credit. *Pizzo and staff*

**369. Ophthalmic Pathology.** Lectures, seminars, and laboratory sessions. Review of the normal anatomy and embryology of the eye as a basis for the study of the various ocular disease processes. The more common diseases of the eye will be considered in detail. Problems in ophthalmic pathology discussed together with methods of solving them. 3 units. *Klintworth*

**370. Developmental Pathology and Teratology.** A systematic study of disease processes involving the prenatal, natal, and postnatal period. Emphasis on developmental anatomy and teratogenesis. The format includes seminars and clinicopathologic correlations derived from gross and microscopic material. Prerequisites: Pathology 250 and anatomy and histology. 3 units. *Bradford*



**374. Pulmonary Pathology and Postmortem Pathophysiology.** Emphasis will be on pulmonary pathology and pathophysiology of infectious, metabolic, environmental, and neoplastic diseases, and certain diseases of unknown etiology (e.g., sarcoid, alveolar proteinosis). Ventilatory experiments will be done on excised human lungs. 3 units. *Roggli and staff*

**377. Pathology of the Kidney.** A comprehensive study of pathological, immunological, and clinical features of the glomerulonephritis, and pyelonephritis, as well as of metabolic, congenital, and neoplastic renal disorders. Lectures will be supplemented with gross and microscopic specimens, demonstrations, and special library studies. 3 units. *Howell*

**380. Diagnostic Immunology.** Diagnostic and laboratory procedures used in evaluating immunologic diseases: especially autoimmune, infectious, immunodeficiency, immunoproliferative, and hypersensitivity disorders. Emphasis on the theoretical and practical aspects of testing procedures and their proper interpretation. Consent of instructor required. 2 units. *R. Buckley, Howell, and Zwadyk*

**382. General Pathology for Toxicologists.** General principles of pathology using examples from human and experimental toxicological disease. Prerequisites: courses in biochemistry, physiology, and histology (histology may be taken concurrently). 3 units. *Graham, Jennings, and pathologists from UNC and Research Triangle Park*

**385. Molecular Aspects of Disease.** Background, investigative methods, and recent advances in understanding the molecular basis of selected diseases. In-depth focus on a small number of diseases whose defects are known at genetic or molecular levels. Current integrative approaches to the study of human biology and disease. Prerequisites: introductory cell biology and biochemistry courses. 3 units. *Salvesen and staff*

## COURSES CURRENTLY UNSCHEDULED

**360. Cytochemistry**

**381. Cancer Biology**

## Pharmacology

Professor Means, *Chair* (407 Nanaline H. Duke); Professor Kuhn, *Director of Graduate Studies* (401-I Bryan Research); Professors Abou-Donia, Ellinwood, Mills, Nadler, Schanberg, Slotkin, Stiles, and Strauss; Associate Professors Linney, Parker, McNamara, Schwartz, Shenolikar, and Whorton; Assistant Professors Fine, Freneau, Heitman, Hellinga, McDonnell, Meyer, Pendergast, Peters, Schwinn, VanDongen, and Wang; Professors Emeriti Kirshner, Lack, Ottolenghi, and Wilder; Associate Research Professor Bartolome; Medical Research Professors Elion and Wilson

Pharmacology offers a graduate program which leads to the Ph.D. degree. Training is available in the following specific areas of pharmacology: neuropharmacology, toxicology, developmental, cardiovascular, behavioral, and endocrine pharmacology, regulation of cell growth and differentiation (cancer pharmacology), cellular signaling and receptor structure and function. Because pharmacology is an interdisciplinary science, the department considers applicants with strong undergraduate backgrounds in biological, chemical, and neural sciences. There is no foreign language requirement.

### For Seniors and Graduates

**200. Medical Pharmacology.** This basic course in pharmacology for medical and graduate students describes the action of drugs in relation to biochemical and physiological processes and the rationale for their clinical use. Additional topics include



pharmacokinetics, drugs of abuse, and commonly encountered toxins. Nine lectures and one small-group, case-based discussion per week for eight weeks, April-June. 4 units. *Nadler and staff*

**210, 211. Individual Study and Research.** Directed reading and research in pharmacology. Consent of director of graduate studies required. 3 to 9 units each. Variable credit. *Staff*

**233. Essentials of Pharmacology.** Drug absorption, distribution, excretion, and metabolism. Structure and activity relationships; drug and hormone receptors and target cell responses. Consent of instructor required. Prerequisites: introductory biology; Chemistry 151L; Mathematics 31 and 32. 4 units. *Slotkin and staff*

**233A. Essentials of Pharmacology for Biologists.** Drug disposition, drug metabolism, drug receptor interactions. Prerequisites: introductory biology, Chemistry 151L; Mathematics 31 and 32. 2 units. *Slotkin*

**234. Interdisciplinary Approach to Pharmacology.** Several model systems (cardiovascular, reproductive, neural, and cell cycle) will be used to explore the molecular, biochemical, and physiologic basis of drug action. 4 units. *Shenolikar and staff*

**254. Mammalian Toxicology.** Principles of toxicology as related to humans. Emphasis on the molecular basis for toxicity of chemical and physical agents. Subjects include metabolism and toxicokinetics, toxicologic evaluation, toxic agents, target organs, toxic effects, environmental toxicity, management of poisoning, epidemiology, risk assessment, and regulatory toxicology. Prerequisites: introductory biology, and Chemistry 151L, or consent of instructor. 4 units. *Abou-Donia and staff*

**280. Student Seminar in Pharmacology.** Preparation and presentation of seminars to students and faculty on topics of broad interest to pharmacology. Required of all pharmacology graduate students. 2 units. *Whorton*

#### **For Graduates**

**314. Integrated Case Studies in Toxicology.** Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. Offered on demand. C-L: Environment 314. 1 unit. *Abou-Donia and Richardson*

**331. Laboratory Methods in Pharmacology.** Tutorial laboratory training in various fields of pharmacology including neuropharmacology, cardiovascular pharmacology, biochemical pharmacology, and biophysical pharmacology. Consent of instructor required. 3 to 6 units. Variable credit. *Staff*

**347, 348. Seminar in Toxicology.** A weekly research seminar throughout the year is required of participants in the Toxicology Program. Students, faculty, and invited speakers present their findings. 1 unit each. *Abou-Donia*

**360. Neuropharmacology.** Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Consent of instructor required. C-L: Neurobiology 360. 3 units. *Freneau*

**364. Neurotoxicology.** Adverse effects of drugs and toxicants on the central and peripheral nervous system; target sites and pathophysiological aspects of neurotoxicity; factors affecting neurotoxicity, screening and assessment of neurotoxicity in humans; experimental methodology for detection and screening of chemicals for neurotoxicity. C-L: Neurobiology 364. 3 units. *Abou-Donia and staff*

**372. Research in Pharmacology.** Laboratory investigation in various areas of pharmacology. Credit to be arranged. Variable credit. *Staff*

**417. Cellular Signaling.** See C-L: Cell Biology 417; also C-L: Biochemistry 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

**423. Neurobiological Basis of Behavior.** Survey of neuroanatomical, neurophysiological, neurochemical, and neuropharmacological evidence of central nervous system function as it relates to normal and abnormal behavior. Clinical description, measurement of function, as well as the biological substrates of affective disorders and psychoses will be emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, will be examined. Prerequisites: familiarity with basic neuroanatomy, neurophysiology and neuropharmacology is assumed. 4 units. *Ellinwood and staff*

## **COURSES CURRENTLY UNSCHEDULED**

### **219. Tutorial in Pharmacology**

## **Philosophy**

Professor Flanagan, *Chair* (201E West Duke); Associate Professor Ferejohn, *Director of Graduate Studies* (201D West Duke); Professors Brandon, Golding, Joy, MacIntyre, Mahoney, and Sanford; Associate Professor Posy; Assistant Professors Cooper, Lind, and Schmaltz; Professors Emeriti Peach and Welsh

The Department of Philosophy offers graduate work leading to the A.M. and Ph.D. degrees. Tutorial work complements formal instruction. Students may, after taking a balanced program, specialize in any of the following fields: the history of philosophy, logic, philosophy of science, epistemology, metaphysics, philosophy of mind, philosophical analysis, ethics, aesthetics, political philosophy, philosophy of law, philosophy of medicine, and philosophy of religion.

Individual programs of study are developed for each student. Prior to being admitted to candidacy for the Ph.D. degree, the student must successfully complete courses and examinations covering the following: logic and formal philosophy; value theory; metaphysics, epistemology, and philosophy of science; and the history of philosophy. In these exercises students are expected to combine factual knowledge with critical understanding. Work in a minor or related field, not necessarily confined to any one department, is encouraged but not required. A minor normally includes 6 units for the A.M. or the Ph.D. degree and may include more as a student's program requires or permits.

A student who meets the general requirements of the Graduate School may earn the A.M. degree in philosophy by passing an oral master's examination. This examination, which can be the defense of either a master's thesis or an alternative academic exercise approved by the department and the student's committee, is normally given in the student's fourth term of full-time registration. The examination can be given earlier in two special circumstances:

1. A student with a strong undergraduate background in philosophy who satisfies the department of his or her qualifications by submitting several samples of written work before beginning the program may be admitted to the master's program with the understanding that the master's examination can be given in the second or third term of full-time registration.
2. A student who combines the A.M. program in philosophy with another advanced degree program, such as the programs for the J.D., the M.D., or the Ph.D. in another field, will register as a full-time graduate student of philosophy for only two terms, the minimum registration that meets the general requirements of the Graduate School for the A.M. degree. These two terms of full-time registration need not be consecutive, and their position in the student's overall



program is determined in individual cases. A student in a combined program will normally do some work in philosophy while registered in the student's primary program and do some work in the primary field while registered in philosophy. The master's examination can be given in the second term of full-time registration as a philosophy graduate student or in a later term when the student is registered in the primary program. A student in the philosophy Ph.D. program who meets the general requirements of the Graduate School for the A.M. degree may earn this degree by completing the preliminary exercises for the Ph.D. degree.

A reading knowledge of at least one foreign language, ancient or modern, is required for the Ph.D. degree. More than one language may be required where this is judged appropriate to the research demanded by the candidate's dissertation.

### **For Seniors and Graduates**

**203S. Contemporary Ethical Theories.** The nature and justification of basic ethical concepts in the light of the chief ethical theories of twentieth-century British and American philosophers. 3 units. *Flanagan, Golding, or Lind*

**204S. Philosophy of Law.** Natural law theory and positivism; the idea of obligation (legal, political, social, moral); and the relation of law and morality. 3 units. *Golding*

**206S. Responsibility.** The relationship between responsibility in the law and moral blameworthiness; excuses and defenses; the roles of such concepts as act, intention, motive, ignorance, and causation. 3 units. *Golding*

**208S. Political Values.** Analysis of the systematic justification of political principles and the political values in the administration of law. 3 units. *Golding*

**210. Logic for Computer Science.** See C-L: Computer Science 242. 3 units. *Loveland*

**211S. Plato.** Selected dialogues. C-L: Classical Studies 211S. 3 units. *Ferejohn*

**217S. Aristotle.** Selected topics. C-L: Classical Studies 217S. 3 units. *Ferejohn*

**218S. Medieval Philosophy.** Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

**219S. Late Medieval and Renaissance Philosophy.** Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

**225S. British Empiricism.** A critical study of the writings of Locke, Berkeley, or Hume with special emphasis on problems in the theory of knowledge. 3 units. *Lind or Schmaltz*

**227S. Continental Rationalism.** A critical study of the writings of Descartes, Spinoza, or Leibniz with special emphasis on problems in the theory of knowledge and metaphysics. 3 units. *Schmaltz*

**228S. Recent and Contemporary Philosophy.** A critical study of some contemporary movements, with special emphasis on analytic philosophers. 3 units. *Posy*

**231S. Kant's Critique of Pure Reason.** 3 units. *Posy*

**232S. Recent Continental Philosophy.** Selected topics. 3 units. *Staff*

**233S. Methodology of the Empirical Sciences.** Recent philosophical discussion of the concept of a scientific explanation, the nature of laws, theory and observation, probability and induction, and other topics. Consent of instructor required. 3 units. *Brandon or Cooper*



**234S. Problems in the Philosophy of Biology.** Selected topics, with emphasis on evolutionary biology: the structure of evolutionary theory, adaptation, teleological or teleonomic explanations in biology, reductionism and organicism, the units of selection, and sociobiology. Consent of instructor required. C-L: Botany 234S and Zoology 234S. 3 units. *Brandon*

**235S. Nineteenth-Century German Philosophy.** A critical examination of the writings of Hegel, Marx, or Nietzsche. 3 units. *Staff*

**240S. Philosophical Psychology.** A study of recent work on the nature of the self and the nature and function of consciousness. Work from philosophy, psychology, cognitive neuroscience, and evolutionary biology will be discussed. 3 units. *Flanagan*

**250S. Topics in Formal Philosophy.** Topics selected from formal logic, philosophy of mathematics, philosophy of logic, or philosophy of language. 3 units. *Posy*

**251S. Epistemology.** Selected topics in the theory of knowledge; for example, conditions of knowledge, scepticism and certainty, perception, memory, knowledge of other minds, and knowledge of necessary truths. 3 units. *Sanford*

**252S. Metaphysics.** Selected topics: substance, qualities and universals, identity, space, time, causation, and determinism. 3 units. *Sanford*

**253S. Philosophy of Mind.** Analysis of concepts such as thought and belief; issues such as mind-body relations, thought and action, the nature of persons and personal identity. 3 units. *Sanford*

**289S. Environmental Ethics.** Selected topics involving values and the environment, for example, extending morality to nature, rights of future generations, environmental aesthetics, diversity and stability, ideological biases in ecological knowledge. Consent of instructor required. C-L: Environment 282S. 3 units. *Cooper*

**291S, 292S. Special Fields of Philosophy.** 3 units each. *Staff*

### For Graduates

**300. Problems in the Theory of Value and Judgment.** See C-L: Literature 300; also C-L: English 386. 3 units. *B. H. Smith*

**311. Philosophy and Medicine.** The scope of medicine as a philosophical problem, the concept of health, and investigation of ethical issues arising in medical contexts. Consent of instructor required. 3 units. *Golding*

### COURSES CURRENTLY UNSCHEDULED

**202S. Aesthetics: The Philosophy of Art**

**205S. Philosophy of History**

**254S. Topics in Philosophy of Religion**

**331, 332. Seminar in Special Fields of Philosophy**

## Physical Therapy

Professor Bartlett, *Chair* (050 Hospital); Assistant Professor Gwyer, *Director of Graduate Studies* (050 Hospital); Associate Professors Schenkman and Villanueva; Assistant Clinical Professors Chandler, Figuers, and Riordan; Clinical Associates Crouch, Dore, Lawrence, and Ross; Professors Emeriti Branch and Horton

The Department of Physical Therapy offers an entry level professional program leading to the M.S. degree. To be eligible for admission to the program, applicants must

have obtained a baccalaureate degree and have a background in the basic sciences and social sciences, including course work in biology, chemistry, physics, and psychology.

The program is designed to provide for integration of classroom knowledge and clinical learning experiences essential for the competent practice of physical therapy. In view of this integrated curriculum, failure in a major course within a semester would prevent the student from continuing in the program. Major courses are all courses offered by the Department of Physical Therapy as well as required courses offered by the Departments of Biological Anthropology and Anatomy, and Neurobiology. A grade of F (or noncredit in the case of Physical Therapy 343 and 344) in any of these courses will occasion withdrawal from the program. Program requirements also include a comprehensive examination at the completion of the curriculum and a research project. Further information may be obtained from the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710.

**210. Independent Study.** Designed for nonmajors. Consent of instructor required. Credit to be arranged. Variable credit. *Staff*

**301. Introduction to Scientific Inquiry.** Theory and methods of research process, research design, data collection, preparation of a research proposal. 2 units. *Gwyer and staff*

**303. Research.** Completion of a research project under the supervision of a faculty adviser; instruction in statistical techniques and the use of the computer. 3 to 5 units. Variable credit. *Gwyer and staff*

**313. Physical Agents.** Physical aspects and physiological effects of selected physical agents, including massage, superficial heat and cold, ultraviolet, diathermy, and ultrasound. 2 units. *Staff*

**314. Electrotherapy and Electrodiagnosis.** Physical aspects and therapeutic effects of electrical currents. Electrodiagnostic testing, introduction to electromyography and nerve conduction studies. 1 to 2 units. Variable credit. *Dore*

**317. Kinesiology.** Fundamentals of arthrology and myology, movement and joint description, surface anatomy, principles of biomechanics and anthropometry. 2 units. *Villanueva*

**318. Arthrology and Pathokinesiology.** Detailed study of the arthrology and kinesiology of the trunk and limbs during normal and pathological conditions, with emphasis on the sequential electromyographic and joint motion analysis of body segments during selected human movement patterns, including locomotion. 3 units. *Villanueva*

**319. Introduction to Evaluation and Patient Care.** Orientation to basic patient care skills, including reaction to illness. Introduction to Problem-Oriented Record System. Principles and methods of evaluation, including assessment of muscle function, joint mobility, neurological and respiratory function, posture, gait, and physical level of independence. Opportunities for direct patient care in laboratory and clinic. 3 units. *Ross and Villanueva*

**320. Evaluation and Therapeutic Procedures I.** Specific assessment of neuromuscular and cardiopulmonary functions. Physiological basis of therapeutic intervention and specific exercise programs. 3 units. *Chandler and staff*

**321. Evaluation and Therapeutic Procedures II.** Assessment and treatment of specific neuromuscular and cardiopulmonary problems. Introduction to techniques of neuromuscular facilitation. 2 units. *Figuers*



**322. Evaluation and Therapeutic Procedures III.** Introduction to the neurophysiological basis for evaluation and treatment of children and adults with central nervous system disorders; emphasis on assessment of abnormal movement and selection of appropriate therapeutic programs. Problems associated with spinal cord injuries, methods of therapeutic intervention, and functional testing. 3 units. *Bartlett and Schenkman*

**332. Physical Therapy and Health Services: Administration and Issues.** Planning, organizing, delivering, and evaluating physical therapy and health services. Examination of health policy and issues. Principles of administration, leadership styles, and management roles. 2 units. *Bartlett and Riordan*

**333. Human Development: Pediatrics/Geriatrics.** Aspects of normal human development throughout the life cycle. Clinical features and management of common pediatric and geriatric problems. 2 units. *Riordan and staff*

**334. Introductory Pathology.** Fundamentals of pathology with emphasis on broad concepts of disease. 2 units. *Staff*

**335. Orthopedics.** Detailed examination of the musculoskeletal system, through lecture and laboratory, and the application of findings to the establishment of physical therapy care plans. Introduction to common orthopedic problems and their medical and surgical management. 2 units. *Lawrence*

**336. Medical Sciences.** The clinical manifestations and management of common medical and surgical disorders. Lectures by physicians, physical therapists, clinical pharmacists, and other health personnel; selected laboratory experiences. Areas covered include prosthetics and orthotics, burns, rheumatology, cardiopulmonary disorders, neurology, and neurosurgery. Seminars in patient management. 3 units. *Gwyer and Ross*

**340. Special Topics in Physical Therapy.** Opportunity for study under the direction of an individual staff member. Consent of director of graduate studies required. Credit to be arranged. Variable credit. *Staff*

**343. Directed Clinical Experience in Physical Therapy II.** Full-time supervised clinical learning experiences in physical therapy settings within limited radius of the university. 2 units. *Figuers and clinical staffs*

**344. Directed Clinical Experience in Physical Therapy III.** Full-time supervised clinical learning experiences in physical therapy settings throughout the country. 3 units. *Figuers and clinical staffs*

## **COURSES CURRENTLY UNSCHEDULED**

### **302. Research**

### **342. Directed Clinical Experience in Physical Therapy I**

## **Physics**

Professor Evans, *Chair* (108 Physics); Professor Weller, *Director of Graduate Studies*; Professors Behringer, Bilpuch, Fortney, Goshaw, Han, Johnson, Madey, Meyer, Müller, Palmer, Roberson, Thomas, and Walter; Associate Professors Greenside, Howell, Oh, and Teitsworth; Assistant Professors Gauthier, Lee, Litvinenko, O'Shea, Socolar, and Springer; Professors Emeriti Biedenharn, Fairbank, Lewis, Robinson, and Walker; Research Associate Professor Tornow; Research Assistant Professor Phillips; Adjunct Professors Ciftan, Guenther, and Strosio; Adjunct Associate Professor Skatrud; Adjunct Assistant Professor Everitt; Visiting Assistant Professor Brown

The Department of Physics offers graduate work for students wishing to earn the A.M. or Ph.D. degree. In addition to a balanced program of basic graduate courses, the



department offers specialized courses and seminars in several fields in which research is being done by faculty and staff. With the help of faculty advisors, students select a course program to fit their individual backgrounds and goals, often including work in a related field. Students are encouraged to begin research work early in their careers.

### For Seniors and Graduates

**205. Introduction to Nuclear Physics.** Phenomenological aspects of nuclear physics, interaction of gamma radiation and charged particles with matter, nuclear detectors, particle accelerators, radioactivity, basic properties of nuclei, nuclear systematics, nuclear reactions, particle scattering, nuclear models of the deuteron, nuclear forces, parity. 3 units. *Weller*

**211. Fundamentals of Quantum Mechanics.** Waves and particles, Schrödinger equation, Dirac notation and mathematical tools, fundamental postulates, angular momentum and addition of angular momentum, applications to spin systems, harmonic oscillators, and the hydrogen atom. Prerequisites: Mathematics 111 and Physics 181. 3 units. *Springer*

**212. Applications of Quantum Mechanics.** Application of the fundamental postulates to atomic structure and spectra, solid state phenomena, statistical physics, scattering, perturbative techniques, treatment of systems of identical particles, and nuclear and particle physics phenomenology. Prerequisite: Physics 211. 3 units. *Staff*

**213. Nonlinear Dynamics.** Prerequisites: Computer Science 8 or 53, Mathematics 111, and Physics 51L, 52L. See C-L: Computer Science 264. 3 units. *Behringer or Greenside*

**214. Introduction to Solid-State Physics.** Discussion of solid-state phenomena including crystalline structures, X-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis on understanding electrical and optical properties of solids. Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Electrical Engineering 214. 3 units. *Teitsworth*

**217S. Advanced Physics Laboratory and Seminar.** Experiments involving the fields of electricity, magnetism, heat, optics, and modern physics. 3 units. *Meyer*

**220. Electronics.** Basic elements of modern electronics including AC circuits, transfer functions, solid-state circuits, transistor circuits, operational amplifier applications, digital circuits, and computer interfaces. 3 units. *Fortney*

**222S. General Relativity.** Review of special relativity; ideas of general relativity; mathematics of curved space-time; formation of a geometric theory of gravity; Einstein field equation applied to problems such as the cosmological red-shift and blackholes. Prerequisites: Physics 181 and Mathematics 111 or equivalents. 3 units. *Lee*

**230. Mathematical Methods in Physics.** Includes topics in complex analysis, residue calculus, infinite series, integration, special functions, Fourier series and transforms, delta functions, and ordinary differential equations; and use of MATHEMATICA for graphical, symbolic, and numerical computation. Prerequisite: Mathematics 111. 3 units. *Palmer*

**231. Mathematical Methods in Electromagnetism.** Mathematical topics include vector calculus, curvilinear coordinates, partial differential equations, orthogonal functions, Legendre polynomials, spherical harmonics, Bessel functions, and Green's functions. Topics from electromagnetism include Maxwell's equations, electrostatics, magnetostatics, potential theory, boundary-value problems, macroscopic media, and electromagnetic waves. Uses MATHEMATICA. Prerequisite: Physics 230. 3 units. *Palmer*

**235. Computational Methods in Physics.** Monte Carlo methods; molecular dynamics; simulations on dynamical grids; Fourier transform; ODE solvers; high-performance computing; vectorization and optimization, parallel computing, scientific visualization. Prerequisites: Physics 230 and 231. 3 units. *Trayanov*

**244. Nuclear and Particle Physics.** Current ideas and models in nuclear and particle physics. Experimental methods; nuclear structure; nuclear reactions; families of elementary particles; quarks and gluons; weak interactions. Prerequisite: Physics 211. 3 units. *Staff*

**261. Laser Physics.** Laser physics and laser theory. Electromagnetic radiation and its interaction with matter. Laser excitation, oscillation, modulation, and detection theory. Prerequisites: Electrical Engineering 170L or Physics 182 and Electrical Engineering 211 or Physics 211. C-L: Electrical Engineering 276. 3 units. *Skatrud*

**271. Quantum Optics.** The linear and nonlinear interaction of electromagnetic radiation and matter. Topics include simple theory of lasers, second-harmonic generation, photon echos, bistability, Raman scattering, Brillouin scattering, phase conjugation, two photon lasers, and cooling and trapping of atoms. Prerequisites: Physics 212 and 231. 3 units. *Gauthier*

**281. Classical Mechanics.** Newtonian, Lagrangian, and Hamiltonian methods for classical systems; symmetry and conservation laws; rigid body motion; normal modes and forced oscillations; small nonlinear oscillations; canonical transformations; Hamiltonian chaos. 3 units. *Socular*

#### For Graduates

**303. Introduction to Statistical Mechanics.** Fundamentals of kinetic theory, thermodynamics, and statistical mechanics with applications to physics and chemistry. Prerequisite: Physics 215. 3 units. *Behringer or Greenside*

**304. Advanced Topics in Statistical Mechanics.\*** This course will vary from year to year. Possible topics include Fermi liquids, systems of bosons, many-body theory, nonequilibrium statistical mechanics. Prerequisites: Physics 303 and 316. 3 units. *Staff*

**307. Introduction to Condensed Matter Physics.** Microscopic structure of solids, liquids, liquid crystals, polymers, and spin systems; elastic scattering and long-range order; topological defects; electronic structure of crystals (metals and semiconductors); phonons and inelastic scattering; magnetism; superconductivity. Prerequisite: Physics 215, 231, 303. 3 units. *Socular or Teitsworth*

**308. Introduction to High-Energy Physics.** An overview of elementary particles and forces studied by experiments carried out at the frontier of high-energy physics. Discussion of basic symmetry principles and conservation laws of nature and review of their experimental tests. Development of the quark model of hadrons and comparisons with observed particle spectra. Review of the Standard Model by comparing predictions to current experimental measurements. 3 units. *Goshaw*

**310. Advanced Solid-State Physics.** Advanced energy band theory; Fermi liquid theory; many-body Green functions and diagrammatic techniques; interacting electron gas; superconductivity; applications. Prerequisite: Physics 307 or equivalent. 3 units. *Teitsworth*

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\*Offered on demand.



- 313. Advanced Topics in Nonlinear and Complex Systems.** Prerequisites: Computer Science 264 or Physics 213; recommended: Physics 230, 231, and 303 or equivalents. See C-L: Computer Science 364. 3 units. *Behringer, Greenside, or Palmer*
- 315. Quantum Mechanics I.** Review of fundamental principles, Dirac notation, operators, eigenvalues and eigenfunctions, nonquantum models, multi-electron atoms, perturbation theory, selection rules, time dependent quantum mechanics, two-level atoms and lasers, Heisenberg equations, path integral approach, symmetry, rotation and angular momentum, tensor operators, Wigner-Eckart theorem, angular momentum recoupling, evaluation of matrix elements. 3 units. *Thomas*
- 316. Quantum Mechanics II.** Quantum physics of systems of many identical particles, symmetrization, anti-symmetrization, scattering theory, Born approximation, WKB approximation, partial wave expansion, optical theorem, quantization of continuous systems, one-dimensional string, electromagnetic field, spontaneous emission, second quantization. Prerequisite: Physics 315. 3 units. *Müller or Thomas*
- 317. Relativistic Quantum Mechanics.** Klein-Gordon equation, Lorentz group, Dirac equation, nonrelativistic limit, hydrogen atom, antiparticles, relativistic fields, gauge invariance, Yang-Mills equation, canonical quantization and particle interpretation of fields, Casimir effect, invariant perturbation theory, Feynman propagator, diagrammatic techniques, scattering matrix, applications to elementary particle reactions. Prerequisite: Physics 316. 3 units. *Müller or Springer*
- 319. Advanced Electrodynamics.** Lienard-Wiechart potentials, scattering theory, radiation theory, MHD and plasmas. Prerequisite: Physics 231. 3 units. *Brown*
- 321. Introduction to Accelerator Physics.** Aspects of modern accelerator physics; operation of a variety of accelerators from electron microscopes to large ring machines; phenomena responsible for stability and instability of particle beams. Prerequisite: Physics 231, 281, or equivalents. 3 units. *Litvinenko*
- 332. Advanced Quantum Optics.** Advanced theory of light-matter interactions. Density matrix and semiclassical Bloch-Maxwell equations, three level laser and nonlinear spectroscopic methods. Superradiance in extended media. Electromagnetic field quantization and radiative damping, master equation approach. Noise and fluctuations, first and second order coherence for classical and quantum fields. Dressed state picture of laser cooling. Prerequisite: Physics 231, 316, 317. 3 units. *Thomas*
- 333. Electronic Properties of Submicron Solid-State Devices.** Prerequisite: quantum mechanics. See C-L: Electrical Engineering 312. 3 units. *Strosio*
- 341. Quantum Field Theory.** Path integral quantization, generating functional for Green functions, quantization of gauge fields, perturbative formulations, spontaneous symmetry breaking, Goldstone theorem, Higgs-Kibble mechanism, operator product expansion, renormalization group, anomalies, semiclassical methods, solitons and instantons. Prerequisite: Physics 317. 3 units. *Staff*
- 346. Topics in Theoretical Physics.** Weak interactions and QCD. Calculations in nuclear and particle physics using the standard model of weak interactions and QCD. Perturbative QCD and renormalization groups. Chiral theories. For high energy and nuclear experimentalists and theorists. Prerequisite: Physics 317. 3 units. *Staff*
- 351. Physics Research Seminar.** Series of weekly presentations on research projects under investigation in the department. Credit/no credit. No credit. *Staff*
- 352. Seminar Techniques.** Discussion of ways of presenting seminars and participating in follow-on question periods. Each student is required to present at least one seminar on an appropriate research topic. 1 unit. *Meyer*



**360. Physics of Charged Particle Beams.** Relativistic charged particle dynamics; phase space concepts and emittance; focusing and transport optics; self-consistent theory of beams; emittance growth and control; particle accelerator systems; applications. Prerequisite: Physics 231 or equivalent. 3 units. *O'Shea*

**361. Physics of Free-Electron Lasers.** Seminar course on the basic physical mechanisms and effects responsible for emission and amplification of radiation by electron beams moving through transverse fields. Prerequisites: Physics 316 and 319. 3 units. *Madey*

#### **COURSES CURRENTLY UNSCHEDULED**

**215. Principles of Quantum Theory**

**240. Computer Applications to Physical Measurement**

**309. Solid-State Physics I**

**312. Phase Transitions and Critical Phenomena**

**334. Atomic Physics and Spectroscopy**

**335. Molecular Spectroscopy**

**342. Theory of Elementary Particles.\***

**345. Advanced High Energy Physics**

**397, 398. Low Temperature and Solid-State Seminar**

## **Political Science**

Professor Aldrich, *Chair* (214-B Perkins); Associate Professor Gillespie, *Director of Graduate Studies* (308 Perkins); Professors Ascher, Fish, Grieco, Holsti, Horowitz, Hough, Keohane, Kitschelt, Kornberg, Lange, Mickiewicz, Paletz, and Spragens; Associate Professors Bianco, Eldridge, Grant, Johns, McKean, and Nniou; Assistant Professors Archer, Brehm, Coles, Feaver, Gronke, Hamilton, Orr, Shi, Simmons, and Smith; Assistant Professor of the Practice Curtis; Professors Emeriti Ball, Barber, Braibanti, Cleaveland, Hall, and Leach; Adjunct Professors Kessler and O'Barr; Lecturer Goemans

The Department of Political Science offers graduate work leading to the A.M. and Ph.D. degrees. Before being admitted to candidacy for the Ph.D. degree, an applicant must have qualified for the A.M. degree. Instruction is designed to prepare the student for teaching and research, for government service, and for other work related to public affairs. Before undertaking graduate study in political science, a student is ordinarily expected to have completed at least 12 semester hours of course work in political science. Instruction is currently offered in the following fields: American government and politics, comparative government and politics, political theory, and international relations.

The candidate for the degree of Doctor of Philosophy in political science must take at least fifteen courses in all, including twelve in the department, and demonstrate competence in at least two general fields of the discipline as well as in a third general field or in a specialized subfield or in a field external to the department. The candidate must also fulfill a statistics and/or foreign language requirement.

The terminal degree of Master of Arts, for those who do not intend to continue with doctoral studies, is awarded following successful completion of: (1) eight one-semester courses of 3 units each, at least half of which must be in political science; (2) two other

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\*Offered on demand.

courses of 3 units each or 6 units of ungraded research; and (3) either the A.M. thesis or two seminar-length research papers done for Duke courses with a grade of G+ or above (the student will be required to pass an oral exam with either of these options). In addition, candidates for the A.M. degree must demonstrate competence in one foreign language or in statistics.

Further details on the graduate program in political science, the departmental facilities, the staff, and available financial aid may be obtained from the Director of Graduate Studies, Department of Political Science.

### **For Seniors and Graduates**

**201S. Problems in International Security (D).** Major security issues. Prerequisite: a course in international relations or American foreign policy. 3 units. *Staff*

**202. American Foreign Economic Policy (D).** Formulation and implementation of American foreign economic policy in the twentieth century. Topics include theories of foreign economic policy-making, commercial and monetary policy, energy and agricultural policies, trade and security, aid to developing countries, management of the debt crisis, foreign investment, the industrial policy debate, and multinational corporations and banks. 3 units. *Simmons*

**203S. Issues in Politics and the Media in the United States (A).** Research seminar analyzing significant questions in the relationship between politics and the media of communication. Consent of instructor required. 3 units. *Paletz*

**205S. The Political Economy of Environmental Resources (B).** The rational choice tradition (public goods, collective action, game theory, property rights, new institutionalism) as applied to environmental problems, resource exploitation, environmental justice, and the design of an environmentally sound society. 3 units. *McKean*

**207S. American Constitutional Interpretation (A).** U.S. Supreme Court interpretation of selected provisions of the Constitution. Prerequisites: Political Science 118 or 127 or 143 and consent of instructor. 3 units. *Fish*

**209. Problems in State Government and Politics (A).** 3 units. *Staff*

**213S. Theories of International Political Economy (D).** Comparison and assessment of traditional and modern theories in terms of their logical and empirical validity. 3 units. *Grieco*

**216S. Evolution of European Marxism (C-N).** The central themes in the evolution of European Marxism: socialist thought prior to Marx; the writings of Marx and Engels. The themes are articulated in: Russian Marxism; Soviet Communism and its Marxist critics; the rethinking of Marx's political economy, the theory of the state, and concepts of class consciousness in the works of twentieth-century European Marxists. 3 units. *Coles*

**217. Comparative and Historical Methods (B).** See C-L: Sociology 214. 3 units. *Gereffi, Janoski, Lin, Smith, or Tiryakian*

**218. Political Thought in the United States (C-N).** American political thought through the Civil War period. The Founders and their European antecedents. Debates over the Constitution, slavery, and the Union. 3 units. *Gillespie or Grant*

**220S. Problems in International Politics (D).** Prerequisite: one course in international relations, foreign policy, or diplomatic history. 3 units. *Holsti*

**222. Introduction to Statistical Analysis (C-E).** Basic applications of statistical theory to political questions: research design, hypothesis tests, computer data analysis. Consent of instructor required for undergraduates. 3 units. *Bianco, Brehm, or Gronke*



**223. Ancient Political Philosophy (C-N).** Intensive analysis of the political philosophy of Plato, Aristotle, and other ancient theorists. C-L: Classical Studies 203. 3 units. *Gillespie or Grant*

**224S. Modern Political Theory (C-N).** A historical survey and philosophical analysis of political theory from the beginning of the seventeenth to the middle of the nineteenth century. The rise of liberalism, the Age of Enlightenment, the romantic and conservative reaction, idealism, and utilitarianism. 3 units. *Grant or Spragens*

**225. Topics in Comparative Government and Politics: Western Europe (B).** Topics vary: the development of mass democracy and the welfare state; political and electoral participation and mobilization; social movements and political change; center-periphery conflicts; government and bureaucratic institutions and their relationships to society; the modern welfare state and political economy. 3 units. *Kitschelt or Lange*

**227S. Issues in International Communications (B).** Research seminar analyzing selected political issues in international communications. 3 units. *Paletz*

**228S. Nineteenth- and Twentieth-Century Political Philosophy (C-N).** Topics in nineteenth- and twentieth-century political philosophy, considering such authors as Hegel, Marx, Nietzsche, Kant, Fichte, Dostoevsky, and Heidegger. 3 units. *Coles or Gillespie*

**229S. Contemporary Theory of Liberal Democracy (C-N).** 3 units. *Spragens*

**230S. Introduction to Positive Political Theory (C-E).** Basic concepts of political economy, theory of preference and choice, social choice theory, and decision and game theory. 3 units. *Aldrich, Bianco, or Niou*

**231S. Crisis, Choice, and Change in Advanced Democratic States (B).** Contributions of Marx, Weber, and Durkheim toward analysis of modern democracies. Examination of selected contemporary studies using these three perspectives to highlight processes of change and crisis. Unsettling effects of markets upon political systems, consequences of bureaucratic regulation, and transformation of sources of solidarity and integration in modern politics. 3 units. *Kitschelt*

**232. Political Economy: Theory and Applications (C-E).** Selected topics. 3 units. *Lange*

**233. Intermediate Statistical Methods (C-E).** Applications of regression models of politics emphasizing the effect of assumptions behind Generalized Least Squares regression. Prerequisite: Political Science 222; consent of instructor required for undergraduates. 3 units. *Bianco, Brehm, or Gronke*

**234S. Political Economy of Development: Theories of Change in the Third World (B).** Alternative approaches to political economy and social change in the Third World. C-L: Cultural Anthropology 234S, History 234S, and Sociology 234S. 3 units. *Staff*

**236S. Hegel's Political Philosophy (C-N).** Within context of Hegel's total philosophy, an examination of his understanding of phenomenology and the phenomenological basis of political institutions and his understanding of Greek and Christian political life. Selections from *Phenomenology*, *Philosophy of History*, and *Philosophy of Right*. 3 units. *Gillespie*

**238S. Development of United States Courts of the Fourth Circuit (A).** Examines judges, courts, and law of United States district and old circuit courts and Court of Appeals: Maryland, Virginia, West Virginia, North Carolina, South Carolina, 1789-1958. Consent of instructor required. C-L: History 255A and Law 548S. 3 units. *Fish*

**239. Comparative History and International Relations (D).** Forces central to the practice of politics and international relations. Theoretical perspectives include those of Oswald Spengler, Schumpeter, Marx, Weber, and Aron as well as historical cases such as



the Russian Revolution, the world wars, the Depression, and the nuclear era. 3 units. *Staff*

**240. American Political Behavior (A).** 3 units. *Staff*

**244S. The Politics of the European Community (D).** Historical, theoretical, and analytical treatment of reform and renewal of the European Community: trade, finance, economic and technological relationships. Impact of European Community development on international relations and American foreign policy. 3 units. *Grieco*

**247. Politics and Philosophy of Self and Other (C-N).** Epistemological, ontological, ethical, and political dimensions of relations between self and other. Theorists may include Husserl, Merleau-Ponty, Levinas, Derrida, Adorno, Gadamer, Sartre, Foucault, and Bakhtin. 3 units. *Coles*

**249. The Politics of Health Care (A).** See C-L: Public Policy Studies 253. 3 units. *Sprinkle*

**250S. International Security after the Cold War (D).** Contemporary issues in international security: nuclear proliferation, balance of power, the role of force, alternative viewpoints. Consent of instructor required. 3 units. *Feaver*

**253S. Comparative Government and the Study of Latin America (B).** Current literature on major themes of Latin American politics. 3 units. *Archer*

**254S. Essential Global Democracy (A).** The failure and success in establishing real democracy, including focus on the main leaders. Issues of law, rights, equality, representation, reasoning, and other principles addressed in the context of practical politics. 3 units. *Staff*

**255. Political Sociology (B).** See C-L: Sociology 255. 3 units. *Smith or Tiryakian*

**256S. Arms Control and National Security Policy (D).** The evolution of nuclear weapons and strategy and of global defense policy toward the Soviet Union and other adversaries; the arms control process and nonproliferation. Consent of instructor required. 3 units. *Staff*

**257S. Making American Defense Policy (D).** Theory and practice of politics of national security in the United States. 3 units. *Feaver*

**258. Global Interdependence.** Historical, cultural, political, economic, and technological factors underlying increasing global interdependence. Different forms interdependence can and has taken. Earlier forms of interdependence and the events that shaped their development and destruction. Topics covered include the transmission of technological innovation and of new diseases as well as the rise of economic regionalism and how modern states have organized their responses. Open to seniors and graduate students including those in the professional schools. 3 units. *Aharoni and staff*

**260S. The Tradition of Political Inquiry (C-N).** Past and present problems, goals, presuppositions, and methods. 3 units. *Spragens*

**262S. International Communism (B).** 3 units. *Hough*

**264S. Feminist Theory and the Social Sciences (C-N).** See C-L: Women's Studies 284S; also C-L: Cultural Anthropology 284S, History 284S, Psychology: Social and Health Sciences 284S, and Sociology 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spinner*

**265S. The Process of International Negotiation (D).** See C-L: Public Policy Studies 265S. 3 units. *Mayer*

**266. Comparative Social Policy (B).** See C-L: Public Policy Studies 266. 3 units. *Smith*

**267S. Policy-Making in International Organizations (D).** See C-L: Public Policy Studies 267S. 3 units. *Ascher*

**269S. War and Wealth in the International System (D).** The interaction between international economics and international security. Focus on the security implications for states that result from their participation in the international economy and the impact that these security concerns have on national strategies in the world economy. 3 units. *Grieco*

**270S. Fundamentals of Political Economy (C-E).** Application of economic reasoning to the study of politics. Analysis of campaigns and elections; legislatures; and the regulation of industries. C-L: Economics 280S. 3 units. *Aldrich, Bianco, or Niou*

**271. International Environmental Regimes (B).** Law, politics, and institutional design of international regimes created among nations to cope with environmental problems. Includes study of particular conventions and treaties (for example, acid rain, ozone, carbon reduction, biodiversity, Antarctica, regional seas, ocean dumping), and the environmental implications of international trade rules and regimes (for example, GATT). C-L: Public Policy Studies 258. 3 units. *McKean*

**272. Chinese Foreign Policy (B).** The formulation and development of Chinese foreign relations and foreign policy since 1949. 3 units. *Shi*

**274S. Seminar in Urban Politics and Urban Public Policy (A).** A probing of topical issues in both their theoretical antecedents and their contemporary manifestations. The intellectual debates and scholarly treatments surrounding issues of power in the city, urban redevelopment policy, urban poverty, and race in the city. C-L: Public Policy Studies 275S. 3 units. *Orr*

**275. The American Party System (A).** An intensive examination of selected facets of American national political parties, such as relationships between presidential and congressional politics, the politics of national conventions, recent foreign policy and party alignments, and the controversy over party government. 3 units. *Staff*

**276S. Media and Democratization in Russia.** See C-L: Public Policy Studies 243S. 3 units. *Mickiewicz*

**277. Comparative Party Politics (B).** The impact of social and political systems on party structures, functions, ideologies, and leadership recruitment. Emphasis upon research techniques and objectives. 3 units. *Lange*

**278S. Black Political Participation (A).** Topical issues concerning the political participation of African Americans, primarily on the national level. Black voter turnout, the electoral choice, the role of African Americans in the Democratic and Republican parties, black interest group politics, black political opinion, and black political socialization. 3 units. *Orr*

**279S. Political Protest and Collective Mobilization (B).** Survey of theories, methods, and empirical studies of political mobilization outside institutional channels; protest behavior and strategies; responses of the state to these challenges; the success of collective mobilization. Emphasis on comparative analyses of protest in advanced industrial democracies. 3 units. *Kitschelt*

**281. American Political Thought Since the Gilded Age (C-N).** The development of American political thought since the late nineteenth century. Special emphasis on the Progressive era and on modern-day attempts to reconstruct theories of liberalism and democracy. 3 units. *Price*

**282S. Canada (B).** See C-L: History 282S; also C-L: Cultural Anthropology 282S, Economics 282S, and Sociology 282S. 3 units. *Staff*



**283S. Congressional Policy-Making (A).** Lawmaking and oversight of the executive branch by the U.S. Congress. Committee, party, executive, and interest group roles. C-L: Public Policy Studies 283S. 3 units. *Bianco or Gronke*

**284S. Public Policy Process in Developing Countries (B).** See C-L: Public Policy Studies 284S. 3 units. *Ascher*

**299. Advanced Topics in Government and Politics.** Topics vary from semester to semester. A. American Government and Politics B. Comparative Government and Politics C. Political Theory D. International Relations 3 units. *Staff*

#### **For Graduates**

**245. Ethics and Policy-Making (C-N).** Not open to students who have taken Public Policy Studies 116. Graduate status only. See C-L: Public Policy Studies 223. 3 units. *Staff*

**303. Seminar on Statistics.** Application of advanced statistical methods to political science research problems. Primary focus on multiple regression procedures. Emphasis on assumptions, interpretation of results, and use of the computer. Consent of instructor required. 3 units. *Staff*

**304. Classics in American Politics (A).** Introduction to fundamental research and theoretic statements in American politics. 3 units. *Aldrich, Bianco, Brehm, or Paletz*

**305. Seminar in United States Foreign Policy.** Decision making in American foreign policy. The sources, substance, and consequences of United States policy will be examined. The emphasis is on the period since 1945. 3 units. *Holsti*

**306. Public Opinion (A).** Intensive study of the causes and consequences of public attitudes toward politics, with special attention given to recent research in the field. 3 units. *Brehm or Gronke*

**307. Formal Modeling in Political Science.** Introduction to formal analysis of recent work in political science. Focus on a number of important theorems and their proofs drawn from such areas as bargaining, deterrence, public goods, collective choice, electoral politics, and new institutionalism. Students will in the process be expected to begin work on formal proofs of their own. Prerequisite: one course in game theory. 3 units. *Niou*

**308. Individual Research.** Students will conduct research designed to evaluate hypotheses of their choice. Reports on the research must be presented in appropriate professional style. 3 units. *Staff*

**309. Seminar in International Relations.** Critical survey of theories and research in international relations and foreign policy. Emphasis will be placed on the interrelation between theory and research. 3 units. *Holsti*

**310. Scope and Methods in Political Science.** Designed to explore philosophical assumptions in political science, theory, and matters of evidence and judgment, the course is meant to be an introduction to variations in research design, empirical methods, and the execution of research. 3 units. *Staff*

**312. Electoral Behavior (A).** Survey of major themes and controversies in electoral behavior research. Aggregate and individual level analyses of elections; historical and contemporary trends in voting behavior. 3 units. *Aldrich or Gronke*

**313. Seminar in Political Communications.** A field survey with emphasis on politics and media in the United States. 3 units. *Paletz*

**315. Noncooperative Game Theory.** See C-L: Economics 315; also C-L: Statistics 386. 3 units. *Moulin*



**317. The New Institutionalism in Political Science.** Survey of recent developments in information economics, theory of the firm, the property rights paradigm, and contract theory. Emphasis on using these techniques to answer classic questions in political science. 3 units. *Bianco or McKean*

**320. Political Psychology.** Examination of the human political situation through the study of actual problems and solutions at the level of: (1) the individual, (2) political discourse among government officials, (3) public discourse in the media. 3 units. *Staff*

**321. Seminar in Political Theory.** Prerequisite: 6 units in political science elected from 223, 224, 229, 231, or their equivalents. 3 units. *Staff*

**322. Topics in Early Modern Political Thought.** Selected readings from political thinkers ranging from Machiavelli to Mill. 3 units. *Grant or Spragens*

**324. Seminar in Comparative Politics (A).** A field survey with emphasis on the politics of developing areas. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 325. 3 units. *Staff*

**325. Seminar in Comparative Politics (B).** A field survey with emphasis on the politics of advanced industrial democracies. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 324. 3 units. *Staff*

**326. Research Seminar in Comparative Government and Politics.** Seminar in major issues in comparative politics and intensive individual student research projects. 3 units. *Staff*

**327. Comparative Political Behavior.** This seminar critically examines research on variations in elite and mass behavior as well as the conditions affecting that behavior in a variety of Western countries. 3 units. *Kornberg*

**332. Seminar on Political Economy: Micro Level.** Survey of recent work in political science and economics on the organization of institutions: political, sociological, and economic. Focus upon the ways in which rational choice theory is applied to areas outside of economics. 3 units. *Staff*

**333. Seminar in Political Economy: Macro Level.** Survey and analysis of recent work in political science, economics and sociology on the relationships between states and markets. Special emphasis on the ways states influence market outcomes and the ways the organization of power in markets influences state behavior, especially in democratic systems. 3 units. *Lange*

**340. Seminar in American Politics and Institutions.** Survey, analysis, and critique of the literature. 3 units. *Aldrich, Bianco, Brehm, Gronke, or Paletz*

**341. Legislative Politics.** Survey of current research on the legislative branch of government. Topics include: elections, committee systems, oversight, party organizations, and others. 3 units. *Bianco*

**351. Comparative Law and Politics: Ethnic Group Relations (B).** Various approaches to the reduction of conflict in deeply divided societies, primarily in Asia and Africa, with secondary attention to Western countries. The nature of ethnic identity, the sources of group conflict, and the forms and patterns it takes. Methods of analyzing social science materials and utilizing them for the design of politics, laws, and institutions. Consent of instructor required. 3 units. *Horowitz*

**381. Research Seminar in Latin American Government and Politics.** Prerequisite: Political Science 253 or equivalent. 3 units. *Staff*

**390. Research Seminar in International Relations.** Prerequisite: Political Science 226, Political Science 309 or equivalent. 3 units. *Holsti*

**397. Selected Topics in Government and Politics.** Topics vary from semester to semester. 2 units. *Staff*

**398. Selected Topics in Government and Politics.** Topics vary from semester to semester. 3 units. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**204S. Ethics in Political Life (C-N)**

**208S. Analyzing the News (A)**

**211S. Current Problems and Issues in Japanese Politics (B)**

**212S. Domestic Structures and Foreign Policies of Advanced Democratic States (D)**

**214S. The Politics of Scarcity (B)**

**215S. Philosophical Bases of Political Economy and Society (C-E)**

**219S. Film and Politics (A)**

**221S. International Institutions and the World Political Economy (D)**

**226S. Theories of International Relations (D)**

**235S. Comparative Development of Islam (B)**

**237S. Comparative Public Policy (B)**

**241S. The Political Thought of Asia from Manu to Mao (C-N)**

**243S. Political Applications of Game Theory (C-E)**

**246S. Political Hypocrisy and Idealism (C-N)**

**251S. The American Presidency (A)**

**252S. The Nation-State and the International System (D)**

**259S. Low Intensity Conflict and the Lessons of Viet Nam (D)**

**261. Politics and the Future (D)**

**263S. Methods of Political Science (C-E)**

**268. The Regulatory Process (A)**

**280S. Comparative Government and Politics: Sub-Saharan Africa (B)**

**293. Federalism (B)**

**360. Seminar in Government and Politics in the Soviet Union**

#### **RELATED COURSE WORK IN THE SCHOOL OF LAW**

It is possible to receive graduate credit for course work completed in the Duke University School of Law, under regulations referred to in this bulletin under the section on academic regulations.

### **Psychology: Experimental**

Professor Lockhead, *Chair* (224 Sociology-Psychology); Professor Eckerman, *Director of Graduate Studies*; Professors Bettman, C. Erickson, R. Erickson, Gallagher, W. C. Hall, W.



G. Hall, Hasher, Holland, Marsh, Palmer, Payne, Rubin, S. Schiffman, Staddon, and M. Wallach; Associate Professors Meck, Nowicki, Putallaz, Schmajuk, and Williams; Assistant Professors Mazuka, Needham, and Welsh; Research Professors Crovitz and L. Wallach; Professors Emeriti Diamond, Kimble, Kremen, H. Schiffman, and Wing

The department offers graduate work leading to the Ph.D. degree. The areas of concentration are cognitive and sensory sciences, psychobiology and behavioral neuroscience, and developmental psychology. Graduate training in developmental psychology is a collaborative effort with the Department of Psychology: Social and Health Sciences. A brochure is available from the director of graduate studies which describes training in each area in more detail and gives information on financial assistance, facilities, and current research activities. The department has no foreign language requirement.

### **For Seniors and Graduates**

**202S. Autobiographical Memory.** A review and critical analysis of the literature, theory, and empirical study of autobiographical memory within cognitive psychology. 3 units. *Rubin*

**203S. Seminar in Cognitive Neuroscience.** Relating empirical findings in perception and cognition to structures and processes in the brains of animals and people. Emphasis on vision. 3 units. *Lockhead*

**205S. Children's Peer Relations.** Consent of instructor required. See C-L: Psychology: Social and Health Sciences 205S. 3 units. *Putallaz*

**209S. The Cognitive Psychology of Oral Traditions.** The structure of songs and genres from oral traditions and the processes used in their composition, transmission, and recall, analyzed from the perspective of cognitive psychology. 3 units. *Rubin*

**211S. Neural Development and Comparative Cognition.** Current research on neural development of cognitive processing in several sensory systems (for example, auditory, visual, and olfactory systems), and in several species (for example, aplysia, song birds, rats, cats, monkeys, and humans) with regard to how attention and memory processes develop. Both the normal ontogeny of cognitive ability and differentiation that is altered during an early sensitive period of development. 3 units. *C. Williams*

**212S. Human Memory.** Classical and modern literature, data, and theories relating to mechanisms of information processing, storage, and retrieval. C-L: Psychology: Social and Health Sciences 212S. 3 units. *Hasher or Rubin*

**214S. Development of Social Interaction.** Major concepts and methods pertaining to early social development, emphasizing human social behavior and a developmental psychobiological approach. C-L: Psychology: Social and Health Sciences 214S. 3 units. *Eckerman*

**223S. Animal Learning and Cognition: A Neural Network Approach.** Several connectionist theories of animal learning and cognition. Neural network theories of classical conditioning; the concepts of models of the environment, prediction of future events, reliable and salient predictors, redundancy reduction, competition for limited capacity short-term memory, mismatch between predicted and observed events, stimulus configuration, inference generation, modulation of attention by novelty, and timing. Neural networks of operant conditioning; the concepts of goal-seeking mechanisms, response-selection mechanisms, and cognitive mapping. How neural network models permit simultaneous development of psychological theories and models of the brain. Prerequisites: Mathematics 31 and 32, Psychology 111 and 115, and consent of instructor. 3 units. *Schmajuk*



**224S. Timing and Time Perception.** Selected topics dealing with the psychobiological bases of internal clocks used to time in the-seconds-to-minutes range. Impact of neural pacemakers systems on cognitive processes involved in divided attention, temporal memory, and the determination of the quantal unit of time and/or consciousness. 3 units. *Mack*

**230S. Social Behavior of Animals.** Developmental, ecological, and physiological aspects of territorial, sexual, parental, and aggressive behavior. Consent of instructor required. 3 units. *C. Erickson*

**234S. Advanced Personality.** Selected topics of current interest concerning empirical research on personality. Strategies for the definition of research questions and the evaluation of research progress. Consent of instructor required. C-L: Psychology: Social and Health Sciences 234S. 3 units. *M. Wallach*

**261S. Advanced Learning Theory.** Selected topics in the data and theory of basic processes of learning, memory, and motivation in animals and humans. Emphasis on the nature of theory construction and evaluation, and the relation of current perspectives to older ones. Prerequisite: graduate status. 3 units. *Holland*

**270S, A-R, U-Z. Selected Problems.** 3 units. *Staff*

### For Graduates

**315. Seminar in Consumer Behavior.** See C-L: Business Administration 562; also C-L: Psychology: Social and Health Sciences 315. 3 units. *Bettman*

**316. Behavioral Decision Theory.** See C-L: Business Administration 525; also C-L: Psychology: Social and Health Sciences 316. 3 units. *Payne*

**329S. Evolution, Development, and Behavior.** Behavior is affected by and has an effect upon evolution, developmental, and physiological processes. Current concepts and controversies in biopsychology. 3 units. *Staff*

**330S. Learning, Memory, and Cognition.** Current concepts and controversies in the way people and other animals perceive, think, and remember. 3 units. *Staff*

**332. Developmental Psychopathology.** See C-L: Psychology: Social and Health Sciences 332. 3 units. *Lochman and Thompson*

**349-350. Practicum in Psychological Research.** 6 units. *Staff*

**352. Child Assessment.** See C-L: Psychology: Social and Health Sciences 352. 3 units. *Coie and Putallaz*

**396. Graded Research.** 1 to 3 units. Variable credit. *Staff*

**398. Special Readings in Psychology.** 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

**215S. Cognitive Development**

**309. Seminar in Learning**

**310. Seminar in Perception**

**337. Seminar in Sensory Discrimination**

## Psychology: Social and Health Sciences

Professor Costanzo, *Chair*; Professor Roth, *Director of Graduate Studies*; Professor Thompson, *Director of Clinical Training*; Professors Bettman, Blumenthal, Brodie, Carson, Coie,

Craighead, Eckerman, George, Hamilton, Hasher, Martin Lakin, Maddox, Payne, Sheppard, Surwit, Thompson, Vidmar, M. Wallach, and Williams; Associate Professors Anderson, Curry, Day, Gil, Keefe, Linville, Lochman, Logue, Putallaz, Quinn, Siegler, and Spenner; Assistant Professors Fischer, Fredrickson, March, Mazuka, Needham, and Serra; Professors Emeriti Alexander and Borstelmann; Assistant Professors of the Practice Musia Lakin and Terry; Research Professors Goldstein and L. Wallach; Assistant Research Professor Madden; Research Scholar Fairbank

The department offers graduate work leading to the Ph.D. degree in psychology. The program faculty listed above are each members of the department, however, some have their primary appointment in other units of the university including the Business School, Law School, and Medical School. Concentrations of Ph.D. study are: clinical (including developmental psychopathology, adult, and health tracks); human cognition; personality/social; and social and applied developmental psychology. There is particular interest in the conjunction between basic perspectives in psychology and their applied and policy-related derivatives. In addition, the department collaborates with the Department of Psychology: Experimental in the conduct of a Ph.D. concentration in developmental psychology. A brochure is available from the director of graduate studies which describes the programs in more detail and gives information on financial assistance, facilities, and current research activities. The department has no foreign language requirement.

### **For Seniors and Graduates**

**205S. Children's Peer Relations.** An examination of the empirical literature with emphasis on the functions that peers serve for children, the developmental course of these relationships, the clinical ramifications and possible explanations for inadequate peer relations (including an examination of the family's role), and interventions used to improve children's relationships with their peers. Consent of instructor required. C-L: Psychology: Experimental 205S. 3 units. *Putallaz*

**206S. Pediatric Psychology.** The conceptual and methodological bases for the field. Case material illustrating how developmental, biological, and psychosocial processes act together in child health and illness. Focus on adjustment and coping with illness and treatments related to cystic fibrosis, sickle cell disease, cancer, diabetes, and seizure disorders. Consent of instructor required. 3 units. *Thompson*

**207S. Topics in Psychobiology.** The biological substrates of human behavior in health and disease. Drug abuse, alcoholism, depression, schizophrenia, and human aggression. Films and videotapes. Student presentations; patient interviews. 3 units. *Brodie*

**208S. Emotion.** An analysis of theoretical and empirical approaches to understanding emotions, with an emphasis on the functions emotion serves in people's lives. Both classic and contemporary research literatures. Prerequisite: graduate status. C-L: Women's Studies. 3 units. *Fredrickson*

**210S. Cognition.** Schematic view of cognitive psychology plus intensive study of two to three specific research topics such as forms of representation, individual differences, and problem-solving models. Emphasis on alternative experimental and theoretical approaches. Prerequisite: Psychology 92 or 107 or graduate status. 3 units. *Day*

**212S. Human Memory.** See C-L: Psychology: Experimental 212S. 3 units. *Hasher or Rubin*

**214S. Development of Social Interaction.** See C-L: Psychology: Experimental 214S. 3 units. *Eckerman*



**217S. Advanced Social Psychology.** Theoretical and empirical approaches to understanding socially significant human behavior and experience. Review of classic and contemporary research literatures, with an emphasis on applied issues. C-L: Women's Studies. 3 units. *Costanzo, Fischer, or Fredrickson*

**218S. Personality, Stress, and Disease.** The interaction between person and social environment as a contributor to development of physical disease. Both epidemiological and laboratory-based research considered. Prerequisite: Psychology 98 or 109, consent of instructor, or graduate status. 3 units. *Williams*

**227S. Behavioral Physiology: Basic Systems.** Organ systems review of physiology, emphasizing the role of the central nervous system and behavior in physiological function. 3 units. *Surwit*

**228S. Behavioral Physiology: Stress and Disease.** Physiological processes involved in stress and coping; effects on nervous, cardiovascular, immune, and endocrine systems; how stress influences various disorders, that is, depression, cardiovascular disease, and diabetes. 3 units. *Surwit*

**234S. Advanced Personality.** Consent of instructor required. See C-L: Psychology: Experimental 234S. 3 units. *M. Wallach*

**255S. Life-Span Development.** Analysis of development across the life span. Origins and course of cognitive and emotional development; components of personality and social development. Applications to models of both normative and pathological development. 3 units. *Costanzo or Goldstein*

**262S. Minority Mental Health: Issues in Theory, Treatment, and Research.** Survey and discussion of theoretical, research, and clinical issues in minority mental health with special emphasis on African-Americans. 3 units. *Anderson*

**264S. Gender, Hormones, and Health.** Hormone effects on behavior in animals and humans with topics including pubertal, menstrual-cycle, sex-related, and gender-related effects on mood, behavior, cognition, and health. C-L: Women's Studies. 3 units. *Hamilton*

**271S, A-R, U-Z. Selected Problems.** 3 units. *Staff*

**273. Statistics I.** Foundations of probability and statistical inference. Introduction to the general linear model via multiple regression. Emphasis on application via statistical computing with SAS. 3 units. *Terry*

**274. Statistics II.** Basic and advanced ANOVA models via the GLM. Broad-based overview of multivariate models, including MANOVA, canonical correlation, discriminant analysis, and factor analytic models. Emphasis on application and use of computer packages. Prerequisites: Psychology: Social and Health Sciences 273. 3 units. *Terry*

**280S. History and Systems of Psychology.** The birth, course, present, and future of psychology from the ancient philosophers to neural networks and neuroanatomy. 3 units. *Serra*

**284S. Feminist Theory and the Social Sciences.** See C-L: Women's Studies 284S; also C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, and Sociology 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spenner*

**288S. Advanced Topics in Social Science and Law.** Study of one broad domain in social science and law; exact content area to vary by semester. Emphasizes how empirical findings in social science are translated and used by the legal system. Possible areas include women's legal issues, family violence, expert testimony, employment discrimination. Prerequisite: graduate status. 3 units. *Fischer*



**289S. Psychology of Prevention.** Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. 3 units. *Coie*

#### **For Graduates**

**301. Group Psychotherapy and Group Influence Processes.** Theories of group interventions and group techniques. 3 units. *Lakin*

**302. Personality Theory.** An advanced course in the representative theories of human functioning, from Freud to contemporary approaches. 3 units. *Staff*

**304-305. Personality and Psychopathology, I and II.** Semester one considers perspectives and fundamental principles in the study of personality. Semester two is devoted to the implications of these principles for psychopathology and behavior disorders and for the classification of abnormal behavior. 6 units. *Staff*

**307. Models of Intervention and Prevention.** Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. Specific approaches to psychotherapy and psychoeducational therapy will be discussed in relation to the prevention-intervention continuum. 3 units. *Staff*

**311-312. Introduction to Psychology: Social and Health Sciences.** Provides brief coverage of the history of psychology in general, and clinical psychology in particular. Acquaints students with research and clinical work of faculty, and introduces them to elementary questions of ethics in human research, treatment, and prevention. No credit. *Keefe*

**315. Seminar in Consumer Behavior.** See C-L: Business Administration 562; also C-L: Psychology: Experimental 315. 3 units. *Bettman*

**316. Behavioral Decision Theory.** See C-L: Business Administration 525; also C-L: Psychology: Experimental 316. 3 units. *Payne*

**318. Research Design.** Examines the foundations of psychological and scientific inquiry. Emphasis is on applications that are likely to be encountered by the research psychologist. Prerequisite: advanced graduate-level statistics course or equivalent. 3 units. *Terry*

**323, 324. Seminar in Community Psychology.** An examination of the organization and functioning of community systems and an exploration of factors involved in system changes through psychologically based intervention strategies. On-line experiences with school system consultation will provide a primary basis for study. 3 units each. *Alexander or Costanzo*

**332. Developmental Psychopathology.** Consideration of major psychopathological disorders in childhood and adolescence, theories and research on etiology and prediction of disorder. C-L: Psychology: Experimental 332. 3 units. *Lochman and Thompson*

**333. Cognition and Teaching.** An examination of key phenomena and concepts in cognitive psychology (especially in areas of perception, attention, memory, comprehension, mental representation, and problem solving) and their implications for the teaching-learning process at the college level. 3 units. *Day*

**335. Personality Assessment.** Assessment of persons through a variety of methods, including clinical and semistructured interviews. Introduction to self-report and projective testing, and to observational rating methods. Laboratory experiences in clinical setting. 3 units. *Curry*

**339. Ethics for Psychotherapists.** A course for graduate students in the clinical program. 3 units. *Lakin*

**343-344. Clinical Practicum.** Intensive experience and supervision in clinical intervention processes. Student training in psychotherapy strategies and techniques and in clinical consultation skills is conducted in clinical settings. 0 to 6 units. Variable credit. *Staff*

**348. Psychotherapy with Children and Families.** Major theoretical approaches to clinical intervention with children and adolescents, either individually or in the family system context. 3 units. *Coie*

**352. Child Assessment.** Interview methods; intelligence and achievement testing; personality and developmental batteries; peer, teacher, and parental instruments; and observational techniques. C-L: Psychology: Experimental 352. 3 units. *Coie and Putallaz*

**353. Research Practicum in Prevention.** Students will be involved in a short-term research apprenticeship to a faculty member other than their mentor for hands-on experience with research efforts pertinent to the prevention of illness. 3 units. *Staff*

**355-356. Research Practicum.** Students will be involved in a research apprenticeship to a faculty member for hands-on experience with research efforts. 6 units. *Staff*

**397. Graded Research.** 1 to 3 units. Variable credit. *Staff*

**399. Special Readings in Psychology.** 3 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**215S. Cognitive Development**

**220S. Psycholinguistics**

## Public Policy Studies

Professor Ascher, *Chair* (124 Sanford Institute Building); Professor Ladd, *Director of Graduate Studies* (214A Sanford Institute Building); Professors Ascher, Barber (political science), Behn, Clotfelter, Cook, Fleishman (law), Garson (pediatrics and medicine), Healy (environment), Hough (political science), Kuniholm, Ladd, Magat (business), Mickiewicz, Pearsall (engineering), and Price (political science); Associate Professors Conrad, Leitzel, Lipscomb, and McConahay; Assistant Professors Gentry (economics), Hamilton, Mayer, Miller, Miranda, Ramachandran, Smith, Sprinkle (health policy and pediatrics), and Stangl (statistics); Professors of the Practice Boothby, Broder, Brown, Harris, Raspberry, Sanford, and Stubbing; Adjunct Professor Yaggy; Adjunct Associate Professor Arcia; Visiting Associate Professor McElroy; Senior Research Scientist Vaupel; Lecturer Payne; Visiting Lecturers Ammarell, Lin, and Slawson

The graduate program in public policy studies is offered through the Terry Sanford Institute of Public Policy. The objective of the program is to prepare students for jobs, particularly in the public sector, which require analytical skills and a practical understanding of the processes by which policy is made and implemented.

The Master of Public Policy (M.P.P.) degree requires two academic years and a summer internship. The first year is devoted to core courses in policy analysis, including sequences in quantitative methods, economics, political analysis, and ethics. The summer internship is with a federal, state, or local agency of government, a not-for-profit organization, or business. The second-year curriculum includes course work in public management, electives in substantive policy areas, and a master's "memo" to be researched and written on a problem of current policy concern.



Students who are concurrently enrolled in a Ph.D. program or a professional degree program (M.D., J.D., M.B.A., etc.), or who have already obtained such a degree, can apply for an abbreviated version of the M.P.P. program. Such students are excused from most second-year requirements, so ordinarily the M.P.P. can be completed in one additional year. Students usually apply for a joint degree program simultaneously with their applications to the graduate departments or professional schools, or during their first or second year of advanced study.

In addition to the M.P.P., the Sanford Institute offers the Program in International Development Policy (PIDP). This program offers a Master of Arts degree in international development policy that requires two academic years and an internship. A nondegree certificate option is also available. The PIDP is designed for mid-career professionals with at least five years of experience in a development-related field. For more information, please contact the Sanford Institute's Center for International Development Research, Duke University, Box 90237, Durham, North Carolina 27708.

The institute does not award a Ph.D.

More information concerning the M.P.P. programs can be obtained by writing the director of graduate studies.

### **For Seniors and Graduates**

**216S. Economics of Education.** Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Economics 216S. 3 units. *Clotfelter*

**218. Macroeconomic Policy.** Survey of macroeconomic theory and analysis of policies designed to reduce unemployment, stimulate economic growth, and stabilize prices. Conventional monetary and fiscal instruments, employment policies, and new policies designed to combat inflation. C-L: Economics 218. 3 units. *Leitzel or McElroy*

**222. Statistics and Data Analysis for Policymakers.** Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. See C-L: Statistics 210A. 3 units. *Stangl*

**236. Public Management I: Managing Public Agencies.** Operations management, information and performance, personnel management, public sector marketing. 3 units. *Behn or Yaggy*

**238. Public Budgeting and Financial Management.** Fund accounting for government; techniques of financial analysis, including break-even analysis, cost accounting, cash-flow analysis, and capital budgeting; and governmental budgeting, including the budgetary process and reforms, and the budget crunch in the public sector. 3 units. *Stubbing*

**241. Reporting the American People.** Critical analysis of the sources of information the media rely upon in reporting opinion and policy preferences: opinion polls, bell-wethers, informed elites. Includes the design and execution of a public opinion poll on a topic of local or national interest. 3 units. *McConahay*

**242S. Chinese Economy in Transition.** Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. See C-L: Economics 242S. 3 units. *Yang*

**243S. Media and Democratization in Russia.** Analysis of policy, content, and audiences of mass media in the Soviet Union and post-Soviet Russia. Focus on such issues as media access, media markets, television and electoral campaigns, and relationship to political authority. C-L: Political Science 276S. 3 units. *Mickiewicz*

**251S. Regulation of Vice and Substance Abuse.** Focus on activities that have traditionally been defined as vices (including drinking, smoking, use of opiates, gambling, pornography, prostitution) and the problems of regulating and controlling them in a free society. Evaluation of social costs and benefits of various alternative policy



interventions. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Economics 251S. 3 units. *Cook*

**253. The Politics of Health Care.** The history, status, and future of health care policy. Grounded in political theories such as distributive justice, altruism, and contractarianism. Focus on policy formation. Case discussions of American reform controversies in light of international experience. C-L: Political Science 249. 3 units. *Sprinkle*

**255. Health Policy Analysis.** Group analysis of a current health-policy problem. Project involves background research, data acquisition, analysis, writing, and presentation of a substantial policy report. Designed for candidates seeking the undergraduate certificate in health policy. Consent of instructor required. 3 units. *Boychuk*

**256. The Economics of Health Care.** The health care industry and government policies designed to alter market demand and supply relationships: national health insurance, the relationship between insurance, supply constraints, and inflation; the supply and distribution of health manpower; hospital cost containment policy. Prerequisite: Economics 149 or the equivalent or consent of instructor. 3 units. *Lipscomb*

**257. United States Policy in the Middle East.** From World War II to the present with a focus on current policy options. 3 units. *Kuniholm*

**258. International Environmental Regimes.** See C-L: Political Science 271. 3 units. *McKean*

**259S. State and Local Public Finance.** Analysis of state and local revenue sources, intergovernmental fiscal relations, budgets and expenditures, fiscal aspects of economic development, and the municipal bond market. Policy topics include financing schools and transportation systems, tax policy, and current fiscal issues. Prerequisite: Public Policy Studies 217 or equivalent. C-L: Economics 259S. 3 units. *Ladd*

**260. Economic Policy Analysis of Nonrenewable Resources.** Economic analysis of nonrenewable resources, development, and exploration. Relationship between natural resources and other economic sectors. Emphasis on public policy tax and regulatory policy, natural resources in developing economies and foreign investment in the mining sector. Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. C-L: Economics 260. 3 units. *Conrad*

**261. Evaluation of Public Expenditures.** Basic development of cost benefit analysis from alternative points of view, for example, equity debt, and economy as a whole. Techniques include: construction of cash flows, alternative investment rules, inflation adjustments, optimal timing and duration of projects, private and social pricing. Adjustments for economic distortions, foreign exchange adjustments, risk and income distribution examined in the context of present value rules. Examples and cases from both developed and developing countries. C-L: Economics 261 and Environment 272. 3 units. *Conrad*

**262S. Seminar in Applied Project Evaluation.** Initiate, develop, and perform a project evaluation. Range of topics include measuring the social cost of deforestation, the B1 Bomber, a child nutrition program, the local arts program. Prerequisite: Economics 285 or Public Policy Studies 261. C-L: Economics 262S. 3 units. *Conrad*

**264S. Research Seminar: Topics in Public Policy I.** Selected topics. 3 units. *Staff*

**265S. The Process of International Negotiation.** Negotiations between governments or between international institutions and governments. Explorations of historic cases, such as the U.S. -Canada free trade negotiation, the INF talks, and Camp David Summit. C-L: Political Science 265S. 3 units. *Mayer*

**266. Comparative Social Policy.** An examination of social and health policies in advanced industrial countries. Focus on understanding the comparative methods and role of the state, market, and voluntary sector in policy development and implementation. C-L: Political Science 266. 3 units. *Smith*

**267S. Policy-Making in International Organizations.** Emphasis on international financial institutions such as the World Bank and the International Monetary Fund. C-L: Political Science 267S. 3 units. *Ascher*

**271S. Schools and Social Policy.** Public schools as instruments of public policy. Economic and statistical analysis of the educational production process. Consideration of alternative school reforms. 3 units. *Clotfelter*

**272L. Resource and Environmental Economics.** Includes laboratory. Prerequisite: introductory course in microeconomics. See C-L: Environment 270L; also C-L: Economics 270L. 4 units. *Kramer*

**274. Resource and Environmental Policy.** Development of a policy analysis framework for studying resource and environmental policy. Political institutions, interest group theory, public choice theory, role of economics in policy analysis, ethics and values. Application to current and historical U.S. policy issues. Prerequisite: Environment 270L, Public Policy Studies 272, or consent of instructor. C-L: Environment 274. 3 units. *Staff*

**275S. Seminar in Urban Politics and Urban Public Policy.** See C-L: Political Science 274S. 3 units. *Orr*

**283S. Congressional Policy-Making.** See C-L: Political Science 283S. 3 units. *Bianco or Gronke*

**284S. Public Policy Process in Developing Countries.** Policy-making patterns in less developed countries; examples from Latin America, Africa, and Asia. C-L: Political Science 284S. 3 units. *Ascher*

**285. Land Use Principles and Policy.** Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. C-L: Environment 285. 3 units. *Healy*

**286S. Economic Policy-Making in Developing Countries.** Fiscal, monetary, and exchange rate policies in less developed countries; issues in public policy toward natural resources and state-owned enterprises. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Economics 286S. 3 units. *Conrad or Ramachandran*

**288S. Current Issues in United States Federal Tax Policy.** Prerequisite: Economics 149 or consent of instructor. See C-L: Economics 288S. 3 units. *Gentry*

#### **For Graduates**

**217. Microeconomics and Public Policy-Making.** Consumption and production theory, welfare economics, theories of collective choice, market structures and regulation, and nonmarket decision making. Not open to students who have taken Public Policy Studies 110. Graduate status only. 3 units. *Clotfelter or Ladd*

**219. The Politics of the Policy Process.** The formulation of public policies, substantive policies in a variety of contexts from local government to international affairs; the role of legislatures, interest groups, chief executives, and the bureaucracy in defining alternatives and in shaping policy from agenda formulation to implementation. Graduate status only. 3 units. *Ascher, Mayer, or Miller*



**223. Ethics and Policy-Making.** Normative concepts in politics, liberty, justice, and the public interest: historical and philosophical roots, relationship to one another and to American political tradition, and implications for domestic and international problems. Not open to students who have taken Public Policy Studies 116. Graduate status only. C-L: Political Science 245. 3 units. *Staff*

**231. Quantitative Evaluation Methods.** Problems in quantifying policy target variables such as unemployment, crime, and poverty. Experimental and nonexperimental methods for evaluating the effect of public programs, including topics in experimental design, regression analysis, and simulation. Graduate status only. Prerequisite: Public Policy Studies 222 or equivalent. 3 units. *Cook or McConahay*

**232. Microeconomics: Policy Applications.** Cost benefit analysis of public programs. Public utility regulation, pollution regulation, hospital rate setting, regulation of product safety. Quantitative methods and microeconomic theory for analysis of both normative and positive aspects of economic policy. Graduate status only. Prerequisites: Economics 149 or Public Policy Studies 110 or 217 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. C-L: Economics 232. 3 units. *Conrad or Ladd*

**303. Public Policy Workshop I.** Introduction to policy analysis and advising. Emphasis on written and oral communication skills, the substance of public policies, and the role of policy analysts. Open to public policy studies M.P.P. students only. 3 units. *Staff*

**304. Public Policy Workshop II.** The role and influence of policy analysis. The examination of specific public policy cases and recommendations for action. Emphasis on written and oral communications skills. Open to public policy studies M.P.P. students only. 3 units. *Staff*

**305. Public Policy Workshop III.** Emphasis on individual or group projects. Preparation for Master's Memo. Open to public policy studies M.P.P. students only. 3 units. *Yaggy*

**306S. Special Topics in Public Policy.** Selected topics. Prerequisite: graduate level. 3 units. *Staff*

**325S, 326S, A-F. Program in International Development Policy Sector Seminar.** Exploration of the relationships among sectoral policies and sustainable development in less developed countries, with emphasis on a particular sector each year. Consent of instructor required.

- A. Urban and Rural Development in Developing Countries
  - B. Natural Resources and Environmental Policy-making
  - C. Urban Environmental Issues in Developing Countries
  - D. Restructuring the Energy Sector in Developing Countries
  - E. Privatization and the Role of the State in Development
  - F. Central American Resource and Environmental Policy
- Variable credit. *Staff*

**327S, 328S, A-H. Program in International Development Policy Issue Seminar.** Topics in policy issues and institutional structures of sectoral policy-making in less developed countries. Consent of instructor required.

- A. Appropriate Technology and Technology Transfer
- B. Economic Analysis of Nonrenewable Resources
- C. State Reform and Social Sector Policy in Developing Countries
- D. Technology Transfer and Foreign Aid to Developing Countries
- E. Structural Adjustment and Poverty



F. Economic Analysis of Development  
G. Project Evaluation and Development Policy  
H. Economic Foundations of Development Policy  
Variable credit. *Staff*

**388. Research Tutorial in Public Policy.** 3 units. *Staff*

**399. Special Readings in Public Policy Studies.** Variable credit. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**204S. Ethics in Political Life**

**221. Decision Analysis for Public Policymakers**

**237. Public Management II: Managing Public Agencies**

**240S. Analyzing the News**

**245S. Leadership Tutorial**

**250S. Policy, Philanthropy, and the Arts**

**252S. United States Strategic Arms Policy**

**254. Transportation Planning and Policy Analysis**

**269. The Regulatory Process**

**270S. Humanistic Perspectives on Public Policy**

**278. Human Service Bureaucracies**

## **Religion**

Professor Hillerbrand, *Chair* (123A Gray); Professor Clark, *Director of Graduate Studies* (209A Divinity School); Professors D. Campbell, Carroll, Crenshaw, Hauerwas, Heitzenrater, Herzog, Kort, Langford, Lawrence, C. Meyers, E. Meyers, Osborn, Richey, E. Sanders, D. M. Smith, H. Smith, Steinmetz, Surin, Wainwright, and Wintermute; Associate Professors Berger, Bland, Corless, Hays, Peters, and Wacker; Assistant Professors Cornell, Fulkerson, Greggs, Hart, Joyce, Keefe, Martin, and Turner

The Department of Religion offers graduate work in two programs leading to the A.M. and Ph.D. degrees. In Program I, students may major in one of seven fields: (1) Hebrew Bible and Semitics, (2) New Testament and Christian origins, (3) history of Christianity, (4) Christian theology and ethics, (5) history of Judaism, (6) Islamic studies and history of religions, and (7) religion, culture, and critical theory. In addition, students may apply to Program II, which permits more interdisciplinary work and more courses outside the graduate program in religion. Students will be expected to take courses which will contribute to an adequate understanding of their chosen fields of specialization and will be required to take two written preliminary examinations within their field of concentration. In addition to course work in their major field, students will take such other courses in cognate fields as will contribute to the enrichment of their major studies and will be required to take one written preliminary examination in a single cognate area within the department. A minor requirement may be fulfilled by work in a cognate department, such as classical studies, English, history, literature, philosophy, political science, or sociology, and will constitute the outside minor and material for a fourth written preliminary examination. There is, in addition, an oral examination conducted by the student's committee immediately subsequent to the written examinations. A foreign language requirement of two languages must be met before taking the doctoral preliminary examination.

The program of doctoral studies presumes a foundation in the academic study of religion. Students applying for graduate work in religion directly from an undergraduate program should have had a strong undergraduate major in religion, and will be accepted for the Ph.D. program only upon the satisfactory completion of the A.M. degree with the department.

### **For Seniors and Graduates**

**200. Person and Work of Christ.** The problem of knowledge of Christ and formulation of a doctrine of his work and person in the light of biblical eschatology. 3 units. *Staff*

**201. Studies in Intertestamental Literature.** Selected documents of the Apocrypha and Pseudepigrapha examined exegetically and theologically in their relation to post-exilic Judaism. Consent of instructor required. 3 units. *Wintermute*

**202. Language and Literature of Dead Sea Scrolls.** A study in interpretation. Prerequisite: a knowledge of Hebrew. 3 units. *Wintermute*

**203. Studies in American Methodism.** Research seminar devoted to selected topics in the Wesleyan and Methodist traditions in America. 3 units. *Richey*

**204. Origen.** The systematic and apologetic writings of an important Alexandrian thinker and exegete of the third century. 3 units. *Clark*

**206. The Christian Mystical Tradition in the Medieval Centuries.** Reading and discussion of the writings of medieval Christian mystics (in translation). Each year will offer a special focus, such as: women at prayer; fourteenth-century mystics; and Spanish mystics. Less well-known writers as well as giants will be included. 3 units. *Keefe*

**207, 208. Readings from the Hebrew Bible.** Grammar with rapid reading of selected passages, both prose and poetry. Prerequisite: at least one year of Hebrew or consent of instructor. C-L: Old Testament 207, 208. 3 units each. *Greggs*

**209. Old Testament Theology.** Studies of the Old Testament in regard to theological themes and content. 3 units. *Crenshaw*

**211. Authority in Theology.** The idea and function of authority in theology. 3 units. *Fulkerson*

**212. Theories of Religion.** Late nineteenth- and twentieth-century theories, interpretations, and approaches to the study of religion. 3 units. *Hart*

**213. Christian Ethics in America.** Ethical thought in America since Rauschenbush. 3 units. *Hauerwas*

**214. Feminist Theology.** Examination of feminist theologians and religionists, their critical perspective on the Christian tradition and constructive proposals out of the resources of "female experience." 3 units. *Fulkerson*

**216. Syriac.** The script and grammar, with readings from the Syriac New Testament and other early Christian documents. Prerequisites: some knowledge of Hebrew and Aramaic. 3 units. *Wintermute*

**217. Islam in India.** History and thought of major Indian Muslims from Biruni to Wali-Ullah, with special attention to the role of Sufism. An introduction to selected Muslim scholars and saints who contributed to the interaction between Islam and Hinduism in northern India during the second millennium A.D. 3 units. *Lawrence*

**218. Religions of East Asia.** Shinto, Taoism, Confucianism, and East Asian Buddhism studied phenomenologically in relation to the Axial Age. 3 units. *Corless*

**219. Augustine.** The religion of the Bishop of Hippo in late antiquity. C-L: Medieval and Renaissance Studies. 3 units. *Clark*

**220. Rabbinic Hebrew.** Interpretive study of late Hebrew, with readings from the Mishnah and Jewish liturgy. 3 units. *E. Meyers or staff*

**221. Readings in Hebrew Biblical Commentaries.** Selected Hebrew texts in Midrash Aggadah and other Hebrew commentaries reflecting major trends of classical Jewish exegesis. 3 units. *Bland*

**222. John among the Gospels.** A consideration of the character, content, and purpose of the Gospel of John in relation to the synoptic and apocryphal gospels. Prerequisite: one year of Hellenistic Greek. 3 units. *M. Smith*

**223, A-G. Exegesis of the Hebrew Old Testament.**

A. Pentateuch

B. Historical Books

C. Major Prophets

D. Minor Prophets

E. Writings

F. Proverbs

G. Genesis

3 units. *Staff*

**224A. Comparative Semitic I.** An introduction to the morphology and syntax of classical Ethiopic and the Semitic languages of Mesopotamia, together with a consideration of their relationships to Hebrew. 3 units. *Wintermute*

**224B. Comparative Semitic II.** An introduction to the morphology and syntax of classical Arabic and the Semitic languages of Palestine-Syria, together with a consideration of their relationships to Hebrew. 3 units. *Wintermute*

**225. Living Issues in New Testament Theology.** Critical examination of major problems and issues in New Testament interpretation and theology. 3 units. *Staff*

**226, A-F. Exegesis of the Greek New Testament I.**

A. Matthew

B. Romans

C. Mark

E. The Gospel and Epistles of John

F. I and II Corinthians

3 units. *Staff*

**227, A-E. Exegesis of the Greek New Testament II.**

A. Luke

B. Galatians

C. The Pastoral Epistles

D. Epistles of Peter and James

E. Acts

3 units. *Staff*

**227F. Exegesis of the Greek New Testament II: The Synoptic Gospels.** Concentration on the "classical" methods of studying the synoptic gospels: source criticism, form criticism, and redaction criticism. Students expected to become proficient in using the Greek synopsis. Prerequisite: two years of Greek or the equivalent. 3 units. *Sanders*



- 228. Twentieth-Century Continental Theology.** An investigation of leading theologians and theological trends. 3 units. *Osborn*
- 230. Sainthood in Comparative Perspective.** Examination of sainthood, saint cults, and sacred biography from a multidisciplinary and global perspective. 3 units. *Cornell*
- 231S. Seminar in Religion and Contemporary Thought.** Analytical reading and discussion of such critical cultural analysis as is found in the works of Polanyi, Arendt, Trilling, and others, with appraisal of the relevance of theological inquiry. 3 units. *Staff*
- 232S. Religion and Literary Studies.** Theories concerning the relation of religion to literary forms, particularly narrative. 3 units. *Kort*
- 233. Modern Narratives and Religious Meanings.** A study of kinds of religious meaning or significance in representative American, British, and continental fiction of the first half of the twentieth century. 3 units. *Kort*
- 234. Early Christian Asceticism.** The development of asceticism and monasticism in the first six centuries of Christianity. C-L: Women's Studies. 3 units. *Clark*
- 235. Heresy: Theological and Social Dimensions of Early Christian Dissent.** 3 units. *Clark*
- 236. Luther and the Reformation in Germany.** The theology of Martin Luther in the context of competing visions of reform. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*
- 238. Witchcraft in New England.** Examination of historical interpretations of the "problem" of witchcraft in New England with attention to the interpretive issues confronted in the study of religious communities and the contributions of gender studies, sociology, anthropology, and psychology to the study of history. 3 units. *Joyce*
- 239. Introduction to Middle Egyptian I.** Grammar and readings in hieroglyphic texts relating to the Old Testament. 3 units. *Wintermute*
- 242. Life after Death in Semitic Thought.** 3 units. *Staff*
- 247. Readings in Latin Ecclesiastical Literature.** Readings in Latin of pastoral, theological, and church-disciplinary literature from the late patristic and medieval period. Prerequisite: knowledge of Latin. 3 units. *Keefe*
- 248. Theology of Karl Barth.** A historical and critical study of Barth's theology. 3 units. *Osborn*
- 250. Women in the Medieval Church.** The history of the Medieval Church told from its women figures: the life and writings of saints, heretics, abbesses, queens, mystics, recluses, virgins, bishops' wives, and reformers. 3 units. *Keefe*
- 253. Feminist Theory and the Study of Christianity.** Nineteenth- and twentieth-century feminist theories and their implications for Christian doctrine and biblical interpretation. C-L: Women's Studies. 3 units. *Clark and McClintock-Fulkerson*
- 254. Justice, Law, and Commerce in Islam.** Islamic approaches to the legal and ethical regulation of social life. C-L: Law 570. 3 units. *Cornell*
- 257. New Testament Ethics.** Scope and basic problems of New Testament ethics; consideration of two important New Testament books. Problems and issues such as the role of the law, symbolic language in ethical discourse, conscience, homosexuality, the state, and self-deception. 3 units. *Hays*

**258. Coptic.** Introduction to the Sahidic dialect with selected readings from Christian and Gnostic texts. Prerequisite: one year of Greek or consent of instructor. 3 units. *Wintermute*

**259. Icon Theology.** A study of theological controversies surrounding the use of images in Christian worship, followed by an attempt to perceive the symbolic conventions and doctrinal content of some Eastern, Western, and contemporary icons. 3 units. *Wainwright*

**260. Life and Times of the Wesleys.** A seminar on John and Charles Wesley and their colleagues in relation to English culture and religion in the eighteenth century. 3 units. *Heitzenrater*

**263. Third World Theology.** An examination of selected theological writings from Asia, Africa, and Latin America, comparing their perspectives and their unique contributions with contemporary Christian thought. 3 units. *Berger*

**266. Ethics and Health Care.** 3 units. *H. Smith*

**267. American Religious Thought.** Examination of selected classic studies of American religious thought. 3 units. *Richey and Wacker*

**268. Revelation and Authority in the Church.** A critical and constructive examination of contemporary concepts. 3 units. *H. Smith*

**270. American Evangelicalism, Fundamentalism, and Pentecostalism.** A study of some of the major themes in the development of transdenominational evangelicalism and fundamentalism in America from the eighteenth century to the present. This will be a reading seminar involving analyses and discussions of literature (mostly secondary works) important for understanding American evangelicalism as a distinct movement. 3 units. *Wacker*

**272, A-B. The Early Medieval Church.**

A. Selected Readings in Early Medieval Religious Studies

B. Social History of the Church in Europe

Prerequisite: knowledge of Latin. 3 units. *Keefe*

**274A. Philosophies, Sciences, and Theologies of the European Enlightenment: Descartes to Kant.** Western theological thought since the Scientific Revolution, with emphasis on developments and movements that occurred in the seventeenth and eighteenth centuries. Descartes, Locke, Leibniz, Spinoza, Hume, Vico, Lessing, Herder, and Kant. 3 units. *Surin*

**275S. Topics in Early Christian and Byzantine Art.** Consent of instructor required. See C-L: Art 233S; also C-L: Classical Studies 230S and Medieval and Renaissance Studies. 3 units. *Wharton*

**277. Judaism in the Greco-Roman World.** History, religion, and literature of the Jews in Palestine from 200 B.C.E. to 66 C.E. Not open to students who have taken Religion 137. Prerequisite: one year of Greek. 3 units. *Sanders*

**284. The Religion and History of Islam.** Origins and development of the Islamic community and tradition, with particular attention to the religious element. 3 units. *Cornell or Lawrence*

**286. The Second Vatican Council (1962-1965).** A theological introduction to the Second Vatican Council, offering the opportunity to reflect on some of the fundamental aspects of the nature and identity of the Roman Catholic Church. 3 units. *Berger*

**293. Religious Issues in American History.** A reading seminar devoted to selected topics, problems, and issues in American religion. 3 units. *Richey or Wacker*

**295. Religion in the American South.** A study of the interrelationships of southern religion and southern culture. 3 units. *Staff*

**298. Christian Encounters with Other Religions.** A study of the way that Christian intellectuals, theologians, and missionaries have conceived the worth of other world religions. An emphasis on nineteenth and twentieth centuries. 3 units. *Wacker*

### **For Graduates**

**302. Theology of John Wesley.** Critical examination of selected texts of John Wesley with attention to their social and cultural contexts. 3 units. *Heitzenrater*

**303. The Old Testament in the New: New Testament Writers as Interpreters of Scriptures.** This doctoral seminar examines the ways in which New Testament authors read and interpreted Scripture. Working knowledge of Greek and Hebrew required. 3 units. *Hays*

**304. Aramaic.** A study of the Aramaic portions of the Old Testament and selected passages from the Elephantine and Qumran texts. 3 units. *E. Meyers or Wintermute*

**305. The Septuagint.** A study of the modern critical use of the Greek Old Testament. Prerequisites: knowledge of Greek and Hebrew. 3 units. *Peters*

**309. Hermeneutics.** Consideration of the nature of understanding and of several interpretive methods—such as phenomenological, existential, historical, literary, structural—along with their application to New Testament texts, primarily the parables of Jesus. 3 units. *Staff*

**310. Readings in Judaica.** Selected studies in Jewish material culture and problems in Jewish religious and intellectual history. 3 units. *Bland, E. Meyers, and staff*

**311. Pharisaic Judaism in the First Century.** A reading course in first-century Pharisaic Judaism. 3 units. *Sanders*

**312. Pauline Theology.** Studies in some aspects of Paulinism in the light of recent scholarship. 3 units. *Sanders*

**321. The Theology of Paul: Structure and Coherence.** Review of recent critical discussion of Pauline theology, with particular emphasis on the problem of the structure and coherence of Paul's thought. Reading knowledge of German, as well as some previous work in Greek exegesis of the Pauline corpus is required. 3 units. *Hays*

**322. Nineteenth-Century European Theology.** Protestant theology from Kant to Herrmann. 3 units. *Herzog*

**324. Readings in the History of Religion.** An examination of the theories, methods, and purposes of the study of non-Western religions within the Western tradition. 3 units. *Staff*

**330. Contemporary Christologies.** A seminar dealing with contemporary Roman Catholic and Protestant Christology. Readings and discussion will focus on theological proposals from major contemporary figures. 3 units. *Wainwright*

**332. System in Theology.** An examination of the various factors that go into the shaping of a systematic theology, followed by a study of several recent and contemporary examples of the genre. 3 units. *Wainwright*

**333. The Doctrine of the Trinity.** Biblical bases, patristic developments, contemporary statements and connections. 3 units. *Wainwright*



**337. Theology of St. Thomas Aquinas.** Intensive reading of the *Summa Theologica* and biblical commentaries. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

**338. Calvin and the Reformed Tradition.** The theological development of John Calvin. A comprehensive examination of his mature position with constant reference to the theology of other reformers. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

**339. The Radical Reformation.** Protestant movements of dissent in the sixteenth century. Special attention will be devoted to Müntzer, Carlstadt, Hubmaier, Schwenckfeld, Denck, Marpeck, Socinus, and Menno Simons. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

**340, 341. Seminar in the New Testament.** Research and discussion on a selected problem in the biblical field. Spring only. 3 units each. *Staff*

**345. Catholic Moral Theology: Its History and Contemporary Issues.** The development of Catholic social and moral theory from a historical and analytical perspective. Study of the Catholic social encyclicals as well as the casuistical tradition. Reading of works by Rahner, Haering, Fuchs, Schuller, McCormick, and Curran. 3 units. *Hauerwas*

**347. Hebrew Narrative Art.** Analysis of the literary craft of selected biblical narratives, and critique of various approaches to studying the art of Hebrew narrative. Prerequisites: knowledge of Hebrew and consent of instructor. 3 units. *Crenshaw*

**348. Seminar in Theological Ethics.** Philosophical paradigms and the nature of the Christian life. 3 units. *Hauerwas*

**349. History and Historiography of Religion in North America.** An opportunity for advanced students in North American religious studies to deepen their understanding of some of the major questions in the field. Examination of how religious history is actually written—with special attention to the imaginative and moral motivations that enter into that process. 3 units. *Wacker*

**350, 351. Old Testament Seminar.** Research and discussion on selected problems in the Old Testament and related fields. Fall only. 3 units each. *Staff*

**352. Seminar in Christian Theology.** Research and discussion of a selected problem in the systematic field. 3 units. *Staff*

**354. Contemporary American Religion.** A seminar dealing with trends in American religion in the twentieth century; critical assessment of primary paradigms for interpreting American religious change, and examination of major characteristics and issues facing American religion. 3 units. *Carroll*

**355. Islam and Its World.** An introduction to the Qur'an, theological doctrines, Islamic law and its interpretations, the Islamic state, the religious "establishment," Sufism, and the sectarian differences between Sunni and Shi'ite Islam as it is practiced in Cairo. 3 units. *Cornell*

**356. History and Culture of Islamic Cairo.** Focus on the evolution of Islamic Cairo, also emphasizing the basis of Islam's wealth, its agriculture, industry, and trade. C-L: History 356. 3 units. *Cornell*

**360. Special Problems in Religion and Culture.** Intensive investigation of the relations of religion and modernity, using seminal contemporary texts. Topics announced each semester. Consent of instructor required. 3 units. *Staff*

**362. Readings in Old Testament and Semitic Studies.** Selected studies in the Hebrew Bible and the languages and literatures of the ancient Near East. 3 units. *Staff*

**363. Readings in New Testament and Christian Origins.** Selected studies on a theme in modern New Testament scholarship. 3 units. *Staff*

**364. Readings in History of Christianity.** Selected issues in the social, material, and intellectual history of Christianity. 3 units. *Staff*

**365. Readings in Christian Theology and Ethics.** An examination of selected topics of historical and contemporary interest in these fields. 3 units. *Staff*

**366. Readings in History of Religions.** Selected studies in cross-cultural and intercreedal material, together with assessment of the problems they pose for the study of religion. 3 units. *Staff*

**367. Readings in Religion and Culture.** Analysis and discussion of theories and of individual research projects. 3 units. *Staff*

**383. Moral Theology in the Twentieth Century.** Critical and comparative examination of ethical theory as exhibited in the work of selected contemporary theologians. 3 units. *H. Smith*

**389. Christian Ethics and Contemporary Culture.** A study of the interaction between Christian thought and current social theory. 3 units. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**205. War and the Christian Tradition**

**210. Contemporary British Theology**

**237. History of the Ancient Near East**

**240. Introduction to Middle Egyptian II**

**241. Problems in Reformation Theology**

**243. Archaeology of Palestine in Biblical Times**

**244. Archaeology of Palestine in Hellenistic-Roman Times**

**245. Ethics in World Religions**

**246. Problems in Historical Theology**

**249. The Lord's Prayer**

**251. Counter-Reformation and Development of Catholic Dogma**

**252. Nineteenth- and Twentieth-Century Roman Catholic Theology**

**255. Christians in Religious Dialogue**

**256. John Wesley in Controversial and Ecumenical Theology**

**261. Islam in the African-American Experience**

**262. Marxist Ideology and Christian Faith**

**264. The Sociology of the Black Church**

**269S. Feminist Theory and the Humanities**

**271. Christologies of the Early Church**

**274B. Philosophies, Sciences, and Theologies after the European Enlightenment: Schleiermacher to Troeltsch**

- 276. The Sacraments in the Patristic and Early Medieval Period
- 279. Understandings of the Resurrection in Contemporary Thought
- 280. The History of the History of Religions
- 283. Islam and Modernism
- 288. Buddhist Thought and Practice
- 289. Theology and Contemporary Secular Understanding of Human Nature
- 290. Current Problems in Christian Social Ethics
- 291. Historical Forms of Protestant Ethics
- 292. Happiness, Virtue, and Friendship
- 294. Christianity and American Society
- 296. Community, Faith, and Violence
- 297. Philosophical and Theological Discourses on Modernity
- 299. The Christian Understanding of Human Nature and Destiny
- 300. Systematic Theology
- 301. Seminar in Contemporary Christian Ethics
- 304A. Targumic Aramaic
- 308. Greek Patristic Texts
- 313. The Apostolic Fathers
- 314. Judaism and Christianity in the New Testament
- 315A. Problems in the Study of Paul
- 316S. History of Religions
- 317. Seminar in the Greek Apologists
- 318. Seminar in the Greek Fathers
- 319. The Gospel According to Saint Matthew in Recent Research
- 320. Theology, Power, and Justice
- 325. Philosophical Theology I
- 326. Philosophical Theology II
- 327. Philosophical Method in Religious Studies
- 328. Twentieth-Century European Theology
- 329. Readings in Theology and Language
- 331. Eschatology
- 334. Theology and Reform in the Later Middle Ages
- 335. The English Church in the Eighteenth Century
- 336. Worlds and Texts
- 342. American Religious Biography



- 343. Readings in Ancient Near Eastern Wisdom Literature**
- 344. Zwingli and the Origins of Reformed Theology**
- 346. Practical Reason and Personal Identity: Explorations in Narrative**
- 353. Seminar on Text Criticism**
- 373-374. Elementary Akkadian**
- 380. Existentialist Thought**
- 386. Christianity in Dialogue with Other Faiths**
- 387. Ethical Method**
- 388. Ethics and Medicine**
- 397. Readings in North American Religious History**
- 398. Colloquium on the Teaching of Religion**
- 401. Colloquium on Biblical Studies**

## Romance Studies

Professor Mignolo, *Chair* (205 Languages); Professor Schor, *Director of Graduate Studies* (205 Languages); Professors Bell, Caserta, Garci-Gómez, Jameson, Kaplan, Moi, Mudimbe, Orr, Osuna, Pérez Firmat, Stewart, Tetel, and Thomas; Associate Professors Finecci, Longino, Mudimbe-Boyi, and Solterer; Assistant Professors Moreiras and Vilarós; Research Associate Professor Keineg; Associate Professor of the Practice and Director of Language Programs Tufts; Assistant Professor of the Practice Damasceno; Research Professor Dorfman

The Department of Romance Studies offers graduate work leading to the Ph.D. degree in French and Spanish. Related work is required in a second Romance language or in any one or two of a number of other subject areas. A reading knowledge of one foreign language which is outside the major language is required. In order to undertake graduate study in Romance languages, the entering student should have credit for at least 18 semester hours (or equivalent) above the intermediate level in the major language.

### FRENCH

#### For Seniors and Graduates

- 200S. Seminar in French Literature.** Topics to be announced. 3 units. *Staff*
- 210. The Structure of French.** Modern French phonology, morphology, and syntax. Readings in current linguistic theory. 3 units. *Thomas*
- 211. History of the French Language.** The evolution of French from Latin to its present form; internal developments and external influences. C-L: Medieval and Renaissance Studies. 3 units. *Thomas*
- 223. Semiotics for Literature.** Theoretical writings in general semiotics by Frege, Peirce, Saussure, Mukarovsky, and Morris and their applications for textual analysis of French literary works by representative contemporary critics such as Eco, Riffaterre, Corti, and Greimas. Taught in English. C-L: Literature 280. 3 units. *Thomas*
- 240. Old French Literature.** An introduction to medieval French literary texts. 3 units. *Solterer*

**256. Modern Literature and History.** The problems of history, society, and politics in literature, through the writings of Rousseau, Tocqueville, Michelet, Flaubert, Hugo, Merleau-Ponty, Foucault, and others. C-L: History 256. 3 units. *Orr*

**258. The Narrative of Social Crisis.** Realism and naturalism, with special emphasis on Balzac, Flaubert, and Zola. 3 units. *Bell, Jameson, Orr, or Schor*

**261. French Symbolism.** Poetry and theories of Baudelaire, Mallarmé, and Rimbaud. Decadence: Lautréamont and Laforgue. 3 units. *Thomas*

**264. Contemporary French Poetry.** The language of poetry. A chronological and theoretical approach to the major poets and movements since 1950. Selections from Bonnefoy, Char, Daive, Deguy, Dupin, Jabès, Jaccottet, Faye, Guillevic, Michaux, Meschonnic, Noël, Oulipo, Ponge, Stefan, Tortel, and others. 3 units. *Orr or Thomas*

**265. French Literature of the Early Twentieth Century.** Emphasis on Gide, Mauriac, Proust, and Colette. 3 units. *Kaplan*

**266. French Literature of the Mid-Twentieth Century.** Emphasis on Malraux, Sartre, Camus, and the *nouveau roman*. 3 units. *Jameson*

**267. Writers, Artists, and Intellectuals in Twentieth-Century France.** Interdisciplinary focus on one figure or one closely connected group of people (writers, artists, filmmakers, intellectuals, and so on); their works studied in their historical and cultural context. 3 units. *Moi*

**281. Paradigms of Modern Thought.** An introduction to contemporary French philosophy with a focus on the notions of identity and difference, the human origin of truth and the question of enunciation. French majors and French graduate students must do course work in French. 3 units. *Mudimbe*

#### **For Graduates**

**300. Graduate Reading Course.** An intensive course in French to develop rapidly the ability to read French in several fields. Graduate students only. No credit. *Staff*

**325. Topics in Renaissance Prose.** Rabelais, Marguerite de Navarre, Montaigne, and others. C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

**326. Topics in Renaissance Poetry.** C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

**348. French Literature of the Seventeenth Century.** The baroque and the classical: form and meaning in the plays of Corneille, Racine, and Molière. Readings in baroque and précieux poetry. C-L: Medieval and Renaissance Studies. 3 units. *Longino*

**351, 352. Literature of the Eighteenth Century.** Problems of literary history, critical reading, and interpretation, focused on varying topics. 3 units each. *Stewart*

**355. Romantic Literature and French Culture and Politics.** A study of French literature in the context of postrevolutionary society and culture. Readings might include nineteenth-century poetry (Hugo, Desbordes-Valmore), theater (Musset), political or philosophical prose, and historical discourse as well as contemporary critical and historical analyses of the period. 3 units. *Orr*

**367. Contemporary French Novel.** A chronological and theoretical approach to the major writers and movements since 1970. Selections from Duras, LeClézio, Sallenave, Modiano, Sollers, Tournier, Oulipo, Yourcenar, and others. 3 units. *Kaplan, Orr, or Thomas*

**368. Structuralism.** An introduction to contemporary French philosophy with a focus on the notions of identity and difference, the human origin of truth and the

question of enunciation. The work of Claude Lévi-Strauss or Michel Foucault will be considered as a paradigm. Additional readings might include chapters from Georges Canguilhem, Vincent Descombes, Jean Hyppolite, Alexandre Kojève, Maurice Merleau-Ponty, and Elliott Valenstein. 3 units. *Mudimbe*

**369. Culture and History in Twentieth-Century France.** An interdisciplinary study of one relatively short historical period (the 1950s, the 1960s, the *entre-deux guerres*, etc.). The intellectual and cultural life of a period in its broader social, political, and historical context. 3 units. *Moi*

**370. Topics in French and Francophone Literature.** Concentration on twentieth-century literature. Historical and theoretical approach. Varying topics. Readings include literary and nonliterary texts. 3 units. *Keineg or Mudimbe-Boyi*

**381. Special Topics Tutorial.** Directed reading and research in areas unrepresented by regular course offerings. 3 units. *Staff*

**391, 392. French Seminar.** C-L: Medieval and Renaissance Studies. 3 units each. *Graduate faculty*

#### **Courses Currently Unscheduled**

**257. Problems of Identity in the Nineteenth-Century Novel**

**263. Contemporary French Theater**

**290S. Studies in a Contemporary Figure**

#### **ITALIAN**

##### **For Seniors and Graduates**

**283. Italian Novel of the Novecento.** Representative novelists from Svevo to the most recent writers. 3 units. *Caserta*

**284, 285. Dante.** 284: *La Vita Nuova* and a close reading of the *Inferno*. 285: The *Purgatorio* and the *Paradiso* in the light of Dante's cultural world. Special attention will be given to the poetic significance of the *Commedia*. Reading in Italian or English. Prerequisite: for 285, Italian 284 or equivalent. C-L: Medieval and Renaissance Studies. 3 units each. *Caserta*

**381. Special Topics Tutorial.** Directed reading and research in areas unrepresented by regular course offerings. 3 units. *Staff*

#### **PORTUGUESE**

##### **For Graduates**

**200S. Seminar in Portuguese Literature.** Topics to be announced. 3 units. *Damasceno*

**202S. Topics in Portuguese and Brazilian Literature and Culture.** Exploration of topics of cultural formation in the Lusophone world that emphasize autochthonous cultural theory. Examples of semester topics: Brazilian cultural theory: modernism to postmodernism; Brazilian popular culture; Portugal post-Salazar. A graduate level course open to juniors and seniors with background in cultural theory. Level of Portuguese required varies with semester topic; consult instructor. 3 units. *Damasceno*

#### **SPANISH**

##### **For Seniors and Graduates**

**200S. Seminar in Spanish Literature.** Topics to be announced. 3 units. *Staff*



**210. History of the Spanish Language.** Formation and development. Internal forces and external contributions. C-L: Medieval and Renaissance Studies. 3 units. *Garci-Gómez*

**244. Topics in Twentieth-Century Latin-American Fiction.** Study of various critical problems in the narrative of the area. Focus on one or more major issues, such as the representation of violence, magical realism, *indigenismo*, *novela de la tierra*. Prerequisite: Spanish 106. 3 units. *Moreiras*

**245. Latin-American Poetry.** Focus on major movements and authors. Non-mainstream poetical traditions, such as poetry written in Quechua, oral poetry. Prerequisite: Spanish 106. 3 units. *Moreiras or staff*

**248. Studies in Spanish-American Literature.** Concentration on single authors, genres, movements, or themes. 3 units. *Staff*

**250. Latin-American Film.** Study of Latin-American film through selected films and critical texts. Attention paid to contemporary production given availability, such as the work of Raúl Ruiz, Miguel Littin, Eliseo Subiela. 3 units. *Moreiras and staff*

**275. Modern Spanish Poetry.** Juan Ramón Jiménez, Unamuno, Antonio Machado, the Generation of 1927, and the contemporary poets. 3 units. *Osuna*

#### **For Graduates**

**341. Colonial Prose of Spanish America.** Narrative forms written in Spanish America during the sixteenth, seventeenth, and eighteenth centuries. C-L: Medieval and Renaissance Studies. 3 units. *Ross*

**342. Colonial Poetry and Theater of Spanish America.** The expression of Renaissance and Baroque styles in the Hispanic New World, including works of Sor Juana, Ruiz de Alarcón, Ercilla, and others. C-L: Medieval and Renaissance Studies. 3 units. *Ross*

**344. Philosophy, Cultural History, and Literature in Latin America.** Special topics. 3 units. *Mignolo*

**346. Modern Spanish-American Fiction.** Twentieth-century novels and short stories by Borges, Carpentier, Cortázar, Gallegos, García Márquez, Quiroga, and others. 3 units. *Pérez Firmat*

**351. The Origins of Spanish Prose Fiction.** Selected examples of the romance and the novel: *Amadís de Gaula*, Diego de San Pedro's *La Cárcel de amor*, the *Abencerraje*, the *Lazarillo*, Montemajor's *Diana*. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**353. Cervantes.** The life and works of Cervantes, with special emphasis on his *Quijote*. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**354. Drama of the Golden Age.** The chief Spanish dramatists of the seventeenth century with readings of representative plays of this period. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**358. Spanish Lyric Poetry before 1700.** A critical study, based on close reading and discussion, of selected poems of the Middle Ages, Renaissance, and baroque. Special emphasis on the *Razón de amor*, *la Poesía de tipo tradicional*, and *Santillana*; on Garcilaso, San Juan de la Cruz, Fray Luis de León, and Herrera; on Góngora and Quevedo. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**360. Cross-cultural (Mis)Understanding: Europe and the New World, 1480-1800.** Survey form or in-depth analysis of specific topics: the interrelations between Europe and the New World from the Renaissance to the Enlightenment, and from the last decades of the Inca and Aztec Empires to the wars of independence. The "clash of

civilizations" and its implications for the cultural history of the early modern period and for the colonial expansion of the west. 3 units. *Mignolo*

**365. Thinking Independence: From Tupac Amaru to 1898.** Study of the cultural problems surrounding the Latin American wars of independence, and the pre- and post-independence periods. May focus on foundational fictions, political writings, the so-called Romantic period. 3 units. *Moreiras*

**366. Nineteenth-Century Prose Fiction.** Readings by novelists such as Valera, Galdós, Alas, and Pardo Bazán in the light of current critical theory. 3 units. *Sieburth*

**370. Spanish Texts of the Post-Dictatorship: 1975 to Present.** An analysis of some artistic and popular productions that came to light in Spain after Franco's death in 1975. Focus on literary and cinematic texts and other cultural productions such as music and comics. 3 units. *Vilarós*

**371. Cultural History and Theory.** Seminar covering various topics in Latin American cultural history and theoretical production such as: (a) colonial legacies and postcolonial theories; (b) the construction of identities and the critique of cultural colonialism; (c) contemporary critical production in Latin America, from dependency theory to transnationalism and postmodernity. May be repeated for credit. 3 units. *Mignolo or Moreiras*

**375. Hispanic Literature, Mass Culture, and Theory.** A study of Hispanic texts thematizing the effects of mass cultural fictions (serial novels, radio songs, movies) on those who consume them. Fictional works will be juxtaposed with theories on the effects of mass culture and its relationship to canonical literature. Authors of fictional texts include Cervantes, Galdós, Martí, Borges, Marsé, Puig, and Martín-Gaité. 3 units. *Sieburth*

**381. Special Topics Tutorial.** Directed reading and research in areas unrepresented by regular course offerings. 3 units. *Staff*

**391, 392. Hispanic Seminar.** Each semester one of the following topics will be selected for intensive treatment: the Spanish language in America, studies in medieval literature, studies in the literature of the Golden Age, studies in Latin American literature, studies in the Spanish Renaissance and baroque, studies in Spanish poetry, studies in nineteenth-century Spanish literature, and studies in twentieth-century literature. C-L: Medieval and Renaissance Studies. 3 units each. *Staff*

#### **Courses Currently Unscheduled**

**262. The Romantic Movement**

**276. Modern Spanish Drama**

**277. Modern Spanish Novel**

#### **ROMANCE STUDIES**

**306. Theories and Techniques of Teaching Foreign Languages.** A survey of approaches to foreign language teaching, an introduction to the theoretical notions underlying current trends, and a language-specific practicum. 3 units. *Tufts*

**310. Critical Frameworks.** An introduction to critical theory through a series of interconnected readings organized around a major theoretical approach or issue. 3 units. *Staff*

#### **Courses Currently Unscheduled**

**218. The Teaching of Romance Languages**



# Slavic Languages and Literatures

Professor Mickiewicz, *Acting Chair*; Assistant Professor Gheith, *Director of Graduate Studies*; Associate Professors Andrews, Dobrenko, and Lahusen; Associate Professor Emeritus Jezierski; Assistant Professors of the Practice Flath, Maksimova, and Van Tuyl

The Department of Slavic Languages and Literatures offers graduate work leading to the A.M. and Ph.D. degrees in Russian literature and Slavic linguistics. Entering students should have had sufficient undergraduate courses in the Russian language to enable them to proceed to more advanced work. Requirements for the A.M. degree may be met by completion of course work and by passing a comprehensive exam. Reading knowledge of French or German is required for both concentrations. All students must demonstrate advanced knowledge of the Russian language. The A.M. program is expected to take one to two years for completion. Candidates for the Ph.D. degree must have received an A.M. degree at Duke or be able to demonstrate that their previous studies qualify as an equivalent to the A.M. degree offered by Duke. Individual programs of study are developed for each student but all students in Russian literature must demonstrate extensive knowledge of Russian literature, competence in another Slavic literature (or, in special circumstances, in a non-Slavic literature), and in literary theory. Literature students must exhibit competence in at least one other Slavic language from the West or South Slavic area. Students in Slavic linguistics must demonstrate competence in Russian and Slavic diachronic and synchronic linguistics, and in general linguistic theory. Linguistics students must demonstrate knowledge of one Slavic language from the West and one from the South Slavic area, in addition to Russian. Knowledge of these areas will be determined through the preliminary examination. Following successful completion of the preliminary examination, students will be expected to write and defend a dissertation based on original research. All Ph.D. candidates are required to teach at least one full academic year as teaching experience is essential in completing one's professional training.

Further information about the graduate programs, including specific requirements, can be obtained from the director of graduate studies.

## RUSSIAN

### For Seniors and Graduates

**201S. Topics in Comparative Slavic Linguistics.** A cycle of survey courses on the phonology, morphology, and dialects of the Slavic languages. Taught in English. Readings in Russian.

- A. East Slavic
  - B. West Slavic
  - C. South Slavic
  - D. Common Slavic
- 3 units. *Andrews or Pugh*

**203S. Old Church Slavonic.** Introduction to the language of the earliest Slavic texts. Close study of phonological and morphological systems, reading of texts and discussion. Taught in English. C-L: Religion 229S. 3 units. *Pugh*

**204S. Russian Folklore and Popular Culture.** Work songs and ritual songs, lamentations, riddles, and proverbs. Tales and later forms of popular creation (*chastushki*, anecdotes, urban romance) and their function in Russian culture. Taught in Russian. 3 units. *Staff*

**205. Semiotics and Linguistics.** A survey of modern semiotics, particularly the works of C. S. Peirce and Umberto Eco. Semiotic works directly related to modern



linguistic thought and linguistic sign theory. Emphasis on the interdisciplinary aspects of semiotic theory. C-L: English 205. 3 units. *Andrews*

**208. Stylistic and Compositional Elements of Scholarly Russian.** Introduction to Russian texts and terminology including business, economics, law, history, political sciences, psychology, linguistics, and literary criticism. Prerequisite: Russian 64 or consent of instructor. 3 units. *Maksimova*

**209. Intensive Advanced Stylistics.** Refinement of stylistic control and range in spoken and written Russian. Emphasis on fluent discursive skills, as well as development of expository prose style. Prerequisites: Russian 195 and 196, or consent of instructor. 6 units. *Maksimova*

**210. Literature and Criticism of Socialist Realism.** The genesis and development of Soviet socialist realism. A survey of Soviet literary theories from Lunacharsky to Ovcharenko, and contemporary Western criticism (for example, K. Clark, R. Robin). A critical approach to the dialogic alternative to monologic literature through literary illustration (selected Soviet literary works from the 1930s to the present day). Taught in English. 3 units. *Lahusen*

**211. Business Russian.** Introduction to Russian language and culture for conducting business in or with Russia and other Commonwealth of Independent States countries. Primary materials include contracts, advertising, and financial documents. 3 units. *Maksimova*

**212S. Proseminar.** Introduction to research methodologies, professional skills (including discussions of teaching), as well as a theoretical basis for students in Slavic linguistics and literature. Mandatory for all graduate students and open to upper-level undergraduates. Team taught; taught in English and Russian. 3 units. *Staff*

**213. Silver Age of Russian Literature.** Poetics of symbolism, acmeism, futurism, imagism, and formalism. Representative world views and critical and artistic methods. Students of Slavic and Russian will read the materials in the original language. 3 units. *Mickiewicz*

**214. Gender, Nationalities, and Russian Literary Traditions.** Russian literature of the nineteenth and twentieth centuries compared with both "Western" and "Eastern" literature of the same time period, including questions of national identity. Readings include: Pushkin, Lermontov, Tur, Aitmatov, and Iskander. C-L: Literature 214 and Women's Studies. 3 units. *Gheith*

**230. Soviet Cinema.** History of Soviet film industry from silent to sound period. Overview of major theorist-filmmakers: Eisenstein, Pudovkin, Vertov. Issues of reception, audience, politics, form, national and ethnic identities. Taught in English. 3 units. *Gaines, Jameson, and Lahusen*

**240S. Russian Literary Discourse.** Nineteenth- and twentieth-century Russian literary theory, with close readings in the original. Application to fiction. Taught in English. 3 units. *Lahusen*

**250. Trends in Russian and East European Literary Criticism and Beyond.** The major critical movements in the nineteenth and twentieth centuries in Russia, East-Central Europe, and the West. Authors and theories include the Belinsky school, formalism, Bakhtin, structuralism, semiotics, and psychoanalytic and feminist theory. Taught in English. 3 units. *Gheith*

**257. Law, Culture, and the Russian Legal Tradition.** A study of the development of the Russian legal tradition, with particular emphasis on the historical and cultural factors that have contributed to its emergence, comparing the Russian tradition with the Western legal tradition. How law, lawyers, and legal institutions have been portrayed

in Russian popular culture, especially Russian literature. Taught in English. 3 units. *Newcity*

**261, 262. Nineteenth-Century Russian Literature.** Selected nineteenth-century authors, works, and genres. Authors include Pushkin, Lermontov, Gogol, Turgenev, Dostoevsky, Tolstoy, and Chekhov. Taught in English. Readings in Russian. 3 units each. *Staff*

**265S. Literature of Early Russia.** Works from the eleventh to the seventeenth centuries, including Ilarion's *Sermon on Law and Grace*, *The Tale of Bygone Years*, *The Igor Tale*, *Domostroi*, *Avvakum's Life*. Readings in Russian. 3 units. *Staff*

**266S. The Sources of Modern Russian Literature: The Eighteenth Century.** Development of the major forms of Russian literature, including verse, drama, and the beginnings of the prose tradition. Authors include Kantemir, Lomonosov, Sumarokov, Trediakovsky, Fonvizin, Derzhavin, and Karamzin. Readings in Russian. 3 units. *Gheith*

**269. Women and Russian Literature.** Women authors in Russia from the eighteenth century to the present: their works and lives. The role that works by women have played in Russian literature and culture. The question of whether women's writing in Russia constitutes a tradition. Authors include Dashkova, Catherine the Great, Kovalevskaja, Kollontai, Chukovskaja, Akhmatova, Petrushevskaja, and Tolstaia. Taught in English. Readings in Russian. C-L: Women's Studies. 3 units. *Gheith*

**272S. Pushkin and His Time.** Pushkin and the literary revolution around 1830. Prose works (*The Tales of Belkin*, *The Queen of Spades*, *The Captain's Daughter*) and major lyrical poetry. Taught in English. Readings in Russian. 3 units. *Gheith or Van Tuyl*

**273S. Gogol.** Life, works, and criticism. Readings include *Dead Souls*, *The Inspector General*, *Petersburg Tales*, and other short fiction. Readings in Russian. 3 units. *Lahusen*

**275. Tolstoy.** Introduction to life, works, and criticism. Readings include: *War and Peace*, *Anna Karenina*, the shorter fiction, dramatic works and essays. Taught in English. Readings in Russian. 3 units. *Van Tuyl*

**276. Dostoevsky.** Introduction to life, works, and criticism. Readings include: *Crime and Punishment*, *The Idiot*, and *The Brothers Karamazov*. Taught in English. Readings in Russian. 3 units. *Flath, Gheith, or Van Tuyl*

**277S. Chekhov.** Drama and prose works. Readings in Russian. 3 units. *Flath*

**278. Russian Short Fiction.** The history, development, and discontinuities of Russian short fiction in the nineteenth and twentieth centuries. Authors include Dostoevsky, Vovchok, Leskov, Chekhov, Gippius, and Zoshchenko. Topics include gender, genre, and national identity in historical/cultural context. Taught in English. 3 units. *Gheith*

**279S. Literature of the Former Soviet Republics.** Ukrainian realism of the nineteenth century, futurism, neoclassicism, and the literary struggle of the 1920s; Belorussian literature; Lithuanian psychological prose; the Estonian experimental novel; Georgian literature from Rustaveli to the philosophical novel of the 1970s; the work of Chingiz Aitmatov; Soviet "recent literacy." Taught in Russian. 3 units. *Dobrenko*

**280. Early Twentieth-Century Russian Literature: From Symbolism to the 1920s.** Symbolism, acmeism, futurism, imagism, proletarian literature. Authors include Bely, Sologub, Bryusov, Blok, Vyacheslav Ivanov, Khodasevich, Akhmatova, Mandelshtam, Mayakovsky, Khlebnikov, Gorky, Bogdanov, Gastev. Readings in Russian. 3 units. *Lahusen*

**281. The 1920s: The Road to a New Synthesis.** The literary struggle of the 1920s; proletarian literature from the Smithy to RAPP, LEF and the fate of the avant-garde, the aesthetic conception of Pereval, the literature of the absurd, Oberiu and the Serapion



**282. Socialist Realism: Soviet Literature of the 1930s and 1940s.** The Stalin era of Russian literature, the genesis and development of socialist realism, Soviet literature and the theme of boundaries and war. Authors include Sholokhov, Ostrovsky, Fadeev, Azhaev, Babaevsky, Kochetov, and Simonov. Readings in Russian. 3 units. *Dobrenko or Lahusen*

**283. Post-Stalinist and Contemporary Soviet Literature.** Literature of the thaw after Stalin: the young prose, little realism, new modernism, and rural prose. Authors include Aksyonov, Trifonov, Baranskaya, Bitov, Solzhenitsyn, Rasputin, Shukshin, and Zalygin. Readings in Russian. 3 units. *Dobrenko or Lahusen*

**284. Late- and Post-Soviet Literature.** From the "recovered" avant-garde to the new literature during the Gorbachev era and beyond. The unmasking of Soviet history and its aestheticization. Underground literature and Soviet postmodernism. Authors include Rybakov, Pietsukh, Petrushevskaya, Kuraev, Tolstaya, Viktor Erofeyev, Makanin, Prigov, and Narbikova. Readings in Russian. 3 units. *Dobrenko, Gheith, or Lahusen*

**285. Babel and the Russian-Jewish Cultural Dialogue of the Twentieth Century.** The Jews and the Russian revolution. The Odessa school in the literature of the 1920s. Works include *Red Cavalry*, *Odessa Stories*, and *The Sunset*. Readings in English or Russian. 3 units. *Dobrenko*

**286S. Zamyatin.** The novel *We*, short fiction, and essays. Taught in English. Readings in English or Russian. Not open to students who have taken the former Russian 177S/277S (Zamyatin). 3 units. *Andrews, Maksimova, or Lahusen*

**287S. Platonov.** The novels *Cheoengur*, *The Foundation Pit*, and shorter fiction. Taught in English. Readings in English or Russian. 3 units. *Lahusen*

**288S. Bulgakov.** Works include *Master and Margarita*, *The White Guard*, *A Theatrical Novel*, and *The Heart of a Dog*. Readings in English or Russian. 3 units. *Andrews, Maksimova, and staff*

**290. Trifonov, or the Life and Death of the Soviet Intelligentsia.** The Russian and Soviet intelligentsia, its role and historical responsibility, depicted by one of the most visible representatives of the "generation of the sixties." Works include *The Exchange*, *Taking Stock*, *The Long Goodbye*, *Another Life*, *The House on the Embankment*, *The Old Man*. Readings in Russian. 3 units. *Dobrenko*

**297. Russian Poetry.** Focus on nineteenth and twentieth centuries, including the Golden Age and the Silver Age. Authors include Pushkin, Lermontov, Bely, Blok, Akhmatova, Tsvetaeva, Mandelshtam, Pasternak, and Mayakovsky. Taught in English or Russian, according to students' Russian language proficiency. Russian texts. 3 units. *Van Tuyl*

**298. Akhmatova.** The works and times of Anna Akhmatova, the most prominent woman poet in Russian history. Focus on Akhmatova's works and the Russian political and artistic milieu of the 1910s and 1920s, socio-literary issues of later periods. Readings include the lyric poems of 1910-60, *Requiem*, and *Poem Without a Hero*. Readings in Russian. 3 units. *Van Tuyl*

### **For Graduates**

**301, 302. Elementary Russian.** Introduction to understanding, speaking, reading, and writing. Audiolingual techniques are combined with required recording-listening practice in the language laboratory. 3 units each. *Staff*



**303, 304. Intermediate Russian.** Intensive classroom and laboratory practice in spoken and written patterns. Reading in contemporary literature. Prerequisite: Russian 301, 302 or consent of instructor. 3 units each. *Staff*

**305, 306. Advanced Russian Conversation and Readings.** Nineteenth- and twentieth-century literature in the original. Conducted in Russian. Prerequisite: Russian 303, 304 or consent of instructor. 3 units each. *Staff*

**307. Advanced Russian.** Advanced grammar review with an emphasis on the refinement of oral and written language skills. Development of writing style through compositions and essays. Prerequisite: Russian 306 or consent of instructor. 3 units. *Andrews*

**308. Advanced Russian: Readings, Translation, and Syntax.** Intensive reading and conversation with emphasis on contemporary Russian literary and Soviet press texts. English-Russian translation stressed. Russian media, including television and films. Prerequisite: Russian 307 or consent of instructor. 3 units. *Andrews*

**309, 310. Russian Stylistics and Conversation.** Refinement of stylistic control and range in spoken and written Russian. Emphasis on fluent discursive skills, as well as development of expository prose style. Prerequisites: Russian 307 and 308, or consent of instructor. 3 units each. *Maksimova*

**311S, 312S. Advanced Russian Language and Culture.** Advanced grammar review with additional emphasis on phonetics and conversation. Culture component includes literature, films, museums, and theater performances. (Taught in St. Petersburg in Russian.) Prerequisite: Russian 306 or equivalent. 3 units each. *Staff*

**335. Contemporary Russian Media.** Analytical readings and study of change and development in all the primary forms of former Soviet mass media from 1985 to the present (newspapers, journals, and television). Topics include censorship, TASS, samizdat. Taught in English. Readings in Russian. Prerequisite: Russian 64 or equivalent. 3 units. *Andrews*

**350. Methods in Teaching Russian.** The theory and practice of teaching Russian language to English-speaking students. 1 unit. *Andrews*

**351. Topics in Teaching Methodology.** Application of linguistic principles in the classroom. No prior knowledge of linguistics required. 2 units. *Staff*

**399. Special Readings.** Advanced readings in nineteenth- and twentieth-century Russian literature in the original. 3 units. *Staff*

#### **Courses Currently Unscheduled**

**207S. Semantics**

#### **BALTO-FINNIC**

##### **For Seniors and Graduates**

**200. Balto-Finnic Linguistics.** Introduction to Balto-Finnic languages with emphasis on the established literary languages, Finnish and Estonian. Analysis of their phonological and morphological structures. Survey of related nonliterary languages such as Karelian and Vepsian. Taught in English. 3 units. *Pugh*

##### **For Graduates**

**301, 302. Elementary Estonian.** Introduction to understanding, speaking, reading, and writing Estonian. No preliminary knowledge of Estonian necessary. 3 units each. *Pugh*

**303, 304. Elementary Finnish.** Introduction to understanding, speaking, reading, and writing Finnish. No preliminary knowledge of Finnish necessary. 3 units each. *Pugh*

## POLISH

### For Seniors and Graduates

**274S. Topics in Polish Literature.** Selected Polish writers and works in their literary and historical contexts. Includes responses of major European and American writers. Taught in English. 3 units. *Staff*

**287. Introduction to Polish Literature.** Survey of nineteenth- and twentieth-century Polish literature. Taught in English. 3 units. *Staff*

### For Graduates

**301, 302. Elementary Polish.** Introduction to understanding, speaking, reading, and writing in Polish. No preliminary knowledge of Polish necessary. 3 units each. *Lahusen*

**303, 304. Intermediate Polish.** Intensive classroom and laboratory practice in spoken and written patterns. Readings in contemporary literature. Prerequisites: Polish 1 and 2, or consent of instructor. 3 units each. *Lahusen*

## SERBIAN AND CROATIAN

### For Graduates

**301, 302. Elementary Croatian and Serbian.** Introduction to understanding, speaking, reading, and writing Croatian and Serbian. No preliminary knowledge of Croatian and Serbian necessary. 3 units each. *Andrews*

## UKRAINIAN

### For Graduates

**301, 302. Elementary Ukrainian.** Introduction to understanding, speaking, reading, and writing Ukrainian. No preliminary knowledge of Ukrainian necessary. 3 units each. *Dobrenko or Pugh*

## Sociology

Professor Land, *Chair* (268 Sociology-Psychology); Professor DiPrete, *Director of Graduate Studies* (341 Sociology-Psychology); Professors Carroll (divinity), K. Cook, P. Cook (public policy and economics), George, Gereffi, Lewin (business), Lin, Myers, O'Barr (cultural anthropology), Simpson, Smith, Spenner, Tiryakian, and Wilson; Associate Professor O'Rand; Assistant Professors Boychuk (health policy research and education), Gao, Gold (psychiatry and Aging Center), Jackson, Janoski, Parnell, Thornton, and Zhou; Professors Emeriti Back, Kerckhoff, Maddox, and Preiss; Research Professor Manton (demographic studies); Visiting Professor Gittler

The department offers graduate work leading to the A.M. and Ph.D. degrees in sociology. Entering graduate students should already have completed a minimum of 12 semester hours in sociology and an additional 12 semester hours in related work (e.g., other social sciences, statistics, computer science, philosophy, mathematics). Accepted applicants who have not had such preparation may be required to take work beyond the usual requirements. Applicants for admission are required to take the verbal and quantitative aptitude tests of the Graduate Record Examination.

The Ph.D. program requires the student to take five core courses and a primary and additional courses in a secondary specialization. The core courses include: Sociological Theory (206), Social Statistics I and II (207, 212), and two out of three methods courses



(208, 214, 215). Specializations (with the associated proseminars indicated in parentheses) include Life Course and Aging Studies (Sociology 221S); Comparative and Historical Sociology (Sociology 222S); Crime, Law, and Deviance (Sociology 223S); Population Studies (Sociology 224S); Organizations, Markets, and Work (Sociology 225S); Medical Sociology (Sociology 227S); and Stratification, Mobility, and Labor Force Behavior (Sociology 228S). A student entering with only an undergraduate degree and adequate course preparation would need to take fourteen courses to satisfy degree requirements. Up to three courses may be transferred for graduate work taken elsewhere.

Further details concerning the general departmental program, the specialities and their requirements, departmental facilities, the faculty, ongoing research, and stipends available may be obtained from the director of graduate studies.

### **For Seniors and Graduates**

**206. Sociological Theory.** Structure, foundations, and historical antecedents of recent formulations of such theoretical approaches as phenomenological sociology, exchange theory, critical theory, structuralism, neo-Marxist sociology, sociobiology, and action theory. 3 units. *Tiryakian or Wilson*

**207. Social Statistics I: Basic Concepts and Methods.** Review of descriptive statistics; probability concepts; statistical inference, t-tests, and the analysis of variance. Bivariate correlation and regression, dummy variables, multiple regression, and the analysis of covariance. Stress on applications. Statistical computing using SPSS and other programs. 3 units. *DiPrete or Land*

**208. Survey Research Methods.** Theory and application of survey research techniques in the social sciences. Sampling, measurement, questionnaire construction and distribution, pretesting and posttesting, response effects, validity and reliability, scaling of data, data reduction and analysis. Prerequisite: Sociology 207 or the equivalent. 3 units. *Lin or Smith*

**211S, A-E. Proseminars in Sociological Theory.** Development of sociological thought; systematic sociological theory; interrelations with other social and behavioral sciences.

- A. Background of Sociology
  - B. Formal Aspects of Theory
  - C. Sociology of Knowledge
  - D. Evolutionary Theory and Sociobiology
  - E. Special Topics in Sociological Theory
- 3 units. *Tiryakian or Wilson*

**212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems.** Model specification, review of simple regression, the Gauss-Markov theorem, multiple regression in matrix form, ordinary and generalized least squares, residual and influence analysis. Path analysis, recursive and nonrecursive structural equation models; measurement errors and unobserved variables. Application of statistical computing packages. Prerequisite: Sociology 207 or equivalent. 3 units. *DiPrete or Land*

**213. Social Statistics III: Discrete Multivariate Models.** Assumptions, estimation, testing, and parameter interpretation for the log-linear, logit, logistic, and probit models. Model comparisons; applications of statistical computing packages and programs. Prerequisite: Sociology 212 or equivalent. 3 units. *DiPrete or Land*

**214. Comparative and Historical Methods.** Introduction to the theory of comparative research and analysis in the social sciences with special emphasis on comparative methods, quasi-experimental designs, and case studies. C-L: Political Science 217. 3 units. *Gereffi, Janoski, Lin, Smith, or Tiryakian*



**215. Basic Demographic Methods and Materials.** Population composition, change, and distribution. Methods of standardizing and decomposing rates, life tables and population models, analysis of data from advanced and developing countries. Applications of computer programs for demographic analysis. Prerequisite: Sociology 207 or equivalent. 3 units. *Myers or Parnell*

**217S, A-F. Proseminars in Social Statistics and Research Methods.** Selected topics in the collection and analysis of social science data.

- A. Discrete and Continuous Models of Measurement
  - B. Hazards Models, Event History Analysis, and Panel Data
  - C. Dynamic Models and Time Series Analysis
  - D. Research Design
  - E. Evaluation Research Methods
  - F. Special Topics in Social Statistics and Research Methods
- 3 units. *DiPrete or Land*

**221S, A-D. Proseminars in Aging and Life Course Analysis.** Selected topics in socialization, human development, status attainment and careers, and the sociology of aging.

- A. Social Structure and the Life Course
  - B. Social Patterns of Personal Development
  - C. Social Gerontology
  - D. Special Topics in Aging and Life Course Analysis
- 3 units. *Jackson, Myers, O'Rand, or Spenner*

**222S, A-G. Proseminars in Comparative and Historical Sociology.** Selected topics in the differentiation and transformation of societies.

- A. Theories of Social Change
  - B. Globalization and Comparative Development
  - C. Societal Transformations and Social Institutions
  - D. Culture, Values, and Ideas
  - E. Social Movements and Political Sociology
  - F. Comparative Social Policies
  - G. Special Topics in Comparative and Historical Sociology
- 3 units. *Gao, Gereffi, Janoski, Lin, Simpson, Smith, or Tiryakian*

**223S, A-E. Proseminars in Crime, Law, and Deviance.** Selected topics in crime and the institutions of social control.

- A. Theories of Crime Causation
  - B. Human Development and Criminal Careers
  - C. Social Control and the Criminal Justice System
  - D. Sociology of Law
  - E. Special Topics in Crime, Law, and Deviance
- 3 units. *Land, Simpson, or Wilson*

**224S, A-F. Proseminars in Population Studies.** Selected topics.

- A. Population Dynamics
  - B. Mortality, Morbidity, and Epidemiology
  - C. Urbanization and Migration
  - D. Demography of the Labor Force
  - E. Demography of Aging
  - F. Special Topics in Population Studies
- 3 units. *DiPrete, Land, Manton, Myers, O'Rand, Parnell, or Smith*

**225S, A-H. Proseminars in Organizations, Markets, and Work.** Selected topics in complex organizations, the labor process, and changing occupations.

- A. Basic Concepts, Theories, and Methods

- B. Organizations and Environments
  - C. Social Psychology of Organizations
  - D. Markets and Market Systems
  - E. Careers and Labor Markets
  - F. Sociology of Work and Industrial Relations
  - G. Special Topics
  - I. Micro Issues
  - H. Special Topics II: Macro Issues
- 3 units. *DiPrete, Gao, Janoski, O'Rand, Spenner, or Thornton*

**226S, A-G. Proseminars in Social Institutions and Processes.** Selected topics in the sociology of institutions and social and institutional behavior.

- A. Social Psychology
  - B. Social Stratification
  - C. Political Sociology
  - D. Sociology of Religion
  - E. Sociology of Science
  - F. Sociology of Education
  - G. Special Topics in Social Institutions and Processes
- 3 units. *Staff*

**227S, A-D. Proseminars in Medical Sociology.** Selected topics in medical sociology.

- A. Social Structure and Health
  - B. Social Behavior and Health
  - C. Organization and Financing of Health Care
  - D. Special Topics in Medical Sociology (for example, social epidemiology, stress and coping, health and aging)
- 3 units. *George, Gold, Jackson, Lin, or Thornton*

**228S, A-F. Proseminars in Stratification, Mobility, and Labor Force Behavior.** Core and special topics in social stratification, including explanations for the existence, amount, and various dimensions of stratification in society; institutions that produce stratification; forces that cause the structure of stratification to vary both over time and across societies; and structures that govern social mobility within and across generations.

- A. Intergenerational Mobility
  - B. Social Structure and the Life Course
  - C. Social Inequality and the Structure of Poverty
  - D. Careers and Labor Markets
  - E. Societal Transformation
  - F. Special Topics in Stratification and Mobility Research
- 3 units. *DiPrete, Lin, Spenner, or O'Rand*

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S, History 234S. 3 units. *Staff*

**255. Political Sociology.** Pluralist, elite, and class theories of the relationship between state and society. Topics include: recent debates on the welfare state, social control, political participation, and state-society relations in socialist economies. C-L: Political Science 255. 3 units. *Smith or Tiryakian*

**282S. Canada.** See C-L: History 282S; also C-L: Cultural Anthropology 282S, Economics 282S, and Political Science 282S. 3 units. *Staff*

**284S. Feminist Theory and the Social Sciences.** See C-L: Women's Studies 284S; also C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, and Psychol-

ogy: Social and Health Sciences 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spenner*

**298S, 299S. Seminar in Selected Topics.** Substantive, theoretical, or methodological topics. 3 units each. *Staff*

### For Graduates

**301. Methodological Issues in Sociology.** Selected issues central to sociological research and sociological knowledge. Epistemological and ontological matters, differences over what sociological questions are, preferred styles of doing research, standards for adequate and appropriate data, and the language of sociological discourse. Examines selected controversial matters, for example, quantitative and qualitative, ethnomethodology, micro- and macrosociology, survey and comparative-historical research, case study and the case, and feminist research. 3 units. *Smith*

**392. Individual Research in Sociology.** Students will conduct on an individual basis research designed to evaluate a sociological hypothesis of their choice. The process must be completed by preparation of a report on this research in adequate professional style. Prerequisite: Sociology 207, 208 or consent of instructor. 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

#### 216. Advanced Methods of Demographic Analysis

## Institute of Statistics and Decision Sciences

Professor West, *Director* (333 Old Chemistry); Associate Professor Wolpert, *Director of Graduate Studies*; Professors Berry, Sacks, and Winkler; Associate Professors Burdick, Johnson, and Reckhow; Assistant Professors Clyde, Lavine, Müller, Parmigiani, Stangl, and Vidakovic; Adjunct Professor Peterson; Adjunct Associate Professor Wilkinson

The Institute of Statistics and Decision Sciences offers graduate study leading to the Ph.D. degree in statistics. It also offers the M.S. degree to students pursuing a Ph.D. degree in the institute or in another department at Duke. The institute is a regular teaching and research department of the university that is internationally recognized as a center of research in theoretical and applied statistics. The faculty are active in the areas of Bayesian statistics and decision sciences, statistical computing, and interdisciplinary applications of statistics. These areas of faculty interest are reflected in the course of study for students in the Ph.D. program offered by the institute.

Distinguishing features of graduate study are the opportunity for thorough preparation in Bayesian as well as classical statistics, and research opportunities at the interface between statistics, decision sciences, and statistical computing. The institute also enjoys close working relationships and research collaborations with other departments at Duke, and with the National Institute of Statistical Sciences (NISS), providing opportunities for graduate students to become involved in applied projects.

Requirements for the Ph.D. degree in statistics include study of statistics, probability, statistical computing, decision sciences and related areas; passing a comprehensive examination (covering those topics) given at the end of the first year, and a preliminary examination (covering areas of possible research interest) at the end of the second year, and completing a dissertation written under the supervision of a faculty advisor.

### For Seniors and Graduates

**205. Probability and Measure Theory.** Introduction to probability spaces, the theory of measure and integration, random variables, and limit theorems. Distribution functions, densities, and characteristic functions; convergence of random variables and of their distributions; uniform integrability and the Lebesgue convergence theorems.



Weak and strong laws of large numbers, central limit theorem. Prerequisites: elementary real analysis and elementary probability theory. 3 units. *Wolpert*

**207. Probability.** Prerequisite: Mathematics 281 or equivalent. See C-L: Mathematics 290. 3 units. *Staff*

**210A. Statistics and Data Analysis for Policymakers.** Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on public policy applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. C-L: Public Policy Studies 222. 3 units. *Stangl*

**210B. Statistics and Data Analysis in Biological Science.** Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on biological science applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Environment 251. 3 units. *Staff*

**213. Introduction to Statistical Methods.** Emphasis on classical techniques of hypothesis testing and point and interval estimation, using the binomial, normal,  $t$ ,  $F$ , and chi square distributions. Not open to students who have had Statistics 114 or Mathematics 136. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. 3 units. *Staff*

**214. Probability and Statistical Models.** An introduction to applied probability and to the parametric probability models commonly used in statistical analysis. The generation of random variables with specified distributions, and their use in simulation. Mixture models; linear regression models; random walks, Markov chains, and stationary and ARMA process; networks and queueing models. Prerequisites: Mathematics 103 and 104 or consent of instructor. 3 units. *Staff*

**215. Statistical Inference.** Classical, likelihood, and Bayesian approaches to statistical inference. Foundations of point and interval estimation, and properties of estimators (bias, consistency, efficiency, sufficiency, robustness). Testing: Type I and II errors, power, likelihood ratios; Bayes factors, posterior probabilities of hypotheses. The predictivist perspective. Applications include estimation and testing in normal models, exponential families, regression and one-way ANOVA, contingency tables. Hierarchical normal models; model choice and criticism. Prerequisite: Statistics 213 or co-registration in Statistics 214 or consent of instructor. 3 units. *Staff*

**216. Generalized Linear Models.** Likelihood-based inference in generalized linear models (GLIMs). Multiple linear regression, theory, and practice. Elements of Bayesian analyses of linear models. Theory of likelihood-based inference for GLIMs. Factor variables and cross-classified data arrays. Discrete models: binary regressions and simple contingency tables. Introduction to log-linear models. Data analysis: model fitting, model choice, and residuals-based diagnostics. Prerequisites: Statistics 214 and coregistration in Statistics 215 or equivalent. 3 units. *Staff*

**221. Bayesian Inference and Decision.** Not open to undergraduates. See C-L: Business Administration 510. 3 units. *Winkler*

**226. Statistical Decision Theory.** Formulation of decision problems; criteria for optimality: maximum expected utility and minimax. Axiomatic foundations of expected utility; coherence and the axioms of probability (the Dutch Book theorem). Elicitation of probabilities and utilities. The value of information. Estimation and hypothesis testing as decision problems: risk, sufficiency, completeness and admissibility. Stein estimation. Bayes decision functions and their properties. Minimax analysis and improper priors.

Decision theoretic Bayesian experimental design. Combining evidence and group decisions. Prerequisite: Statistics 215 or consent of instructor. 3 units. *Staff*

**231. Behavioral Decision Theory.** Not open to undergraduates. See C-L: Business Administration 525. 3 units. *Payne*

**234. Choice Theory.** Not open to undergraduates. See C-L: Business Administration 513. 3 units. *Staff*

**242. Applied Regression Analysis.** Linear regression using both graphical and numerical methods. Model construction, critique, and correction using graphical residual analysis. One-way and two-way analysis of variance; introduction to design of experiments. Use of a standard statistical software package. Applications and examples drawn from various sources, emphasizing the biological and environmental sciences. Prerequisite: Statistics 210B or equivalent. C-L: Environment 255. 3 units. *Staff*

**244. Linear Models.** Multiple linear regression. Estimation and prediction. Likelihood, Bayesian, and geometric methods. Analysis of variance and covariance. Residual analysis and diagnostics. Model building, selection, and validation. Prerequisites: Mathematics 104 and Statistics 113 or 210. C-L: Mathematics 241. 3 units. *Staff*

**245. Introduction to Multivariate Statistics.** Multinormal distributions, multivariate general linear model, Hotelling's  $T^2$  statistic, Roy union-intersection principle, principal components, canonical analysis, factor analysis. Prerequisite: Statistics 244 or equivalent. C-L: Mathematics 242. 3 units. *Burdick*

**246. Experimental Design.** Randomization, blocks, factors, and treatments; random and fixed effects; fractional factorial, Latin squares, and other designs; estimation and testing; optimal design and allocation; informational design. Prerequisites: Statistics 213 and 244 or equivalent. 3 units. *Staff*

**253. Applied Stochastic Processes.** Prerequisite: Mathematics 135 or equivalent. See C-L: Mathematics 240. 3 units. *Staff*

**273. Numerical Analysis.** Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 250; also C-L: Mathematics 221. 3 units. *Greenside or Rose*

**282. Optimization Methods.** Optimization techniques useful in decision making. Numerical techniques for nonlinear optimization, with and without constraints; linear and quadratic programming; applications. Other topics, including dynamic programming, optimal control, and stochastic methods, as time permits. Prerequisites: Mathematics 32 and 104 or equivalent, or consent of instructor; knowledge of a computer programming language is helpful but not required. 3 units. *Wolpert*

**290. Statistical Laboratory.** Introduction to statistical thinking, data management and collection, sampling and design, exploratory data analysis, graphical and tabular displays, summarizing data. Introduction to applied work. Computer orientation, statistical packages and operating systems, especially unix on high-speed workstations, and the statistical package S-Plus. Graphics and numerical computing. Examples from various disciplines. 3 units. *Staff*

**291, 292. Independent Study.** Directed reading and research. Consent of instructor and director of graduate studies required. Variable credit. *Staff*

**293. Special Topics in Statistics.** Advanced topics of current interest. Prerequisite: Statistics 213 or consent of instructor. 3 units. *Staff*



**294. Special Topics in Statistics.** Prerequisite: Statistics 213 or consent of instructor. 3 units. *Staff*

**297. Topics in Probability Theory.** Prerequisite: Mathematics 290 or consent of instructor. See C-L: Mathematics 293. 3 units. *Staff*

### For Graduates

**333. Sequential Statistical Analysis.** Bayesian analysis of sequential statistical procedures. Multi-armed bandit problems: sampling costs and decision costs, Bayesian updating, myopic rules, dynamic programming. Contemporary design of clinical trials. At the level of Sheldon Ross, *Introduction to Stochastic Dynamic Programming* and part four of Morris H. DeGroot, *Optimal Statistical Decisions*. Prerequisite: Statistics 215 or equivalent. 3 units. *Berry*

**345. Multivariate Statistical Analysis.** Review of matrix algebra, transformations, and Jacobians. The multivariate normal, Wishart, multivariate  $t$ , and related distributions are given special emphasis. Topics such as principal components, factor analysis, discrimination and classification, and clustering treated both from classical and Bayesian viewpoints. Additional topics depending on instructor and background of students. Prerequisites: Statistics 215 and Statistics 216. 3 units. *Staff*

**346. Experimental Design and Optimization.** Traditional and modern concepts and techniques in statistical design and experimentation. Industrial experimentation and statistical design in complex, high-dimensional control spaces. Fractional factorial designs and highly fractionated experiments. Response surface methodology. Determination of nonlinearities in response surfaces. Efficient allocation of experimental units to control and treatments, especially with small numbers of expensive units. Bayesian and classical design criteria of optimality. Sequential design and allocation. Prediction from designed experiments. Screening and sensitivity. Data assimilation and tuning. Possible illustrations from studies in semiconductor manufacturing and drug design. 3 units. *Sacks*

**356. Time Series and Forecasting.** Time series data and models: trend, seasonality, and regressions. Traditional models: EWMA, EWR, ARMA. Dynamic linear models (DLMs). Bayesian learning, forecasting, and smoothing. Mathematical structure of DLMS and related models. Intervention, forecast monitoring, and control. Structural change in time series. Multiprocess models and mixture analysis. Multivariate models, constrained and aggregate forecasting, and forecast combination. Applications using computer software. Other topics, including spectral analysis, as time permits. Prerequisite: Statistics 215 or equivalent. 3 units. *West*

**357. Stochastic Processes.** Conditional probabilities and Radon-Nikodym derivatives of measures; tightness and weak convergence of probability measures, measurability and observability. Markov chains, Brownian motion, Poisson processes. Gaussian processes, birth-and-death processes, and an introduction to continuous-time martingales. Prerequisites: Statistics 205 (or Mathematics 290) and Statistics 215 (or Mathematics 136.) 3 units. *Wolpert*

**365. Survival Reliability Analysis.** Statistical models and techniques useful in the comparative study of lifetime distributions. Censoring mechanisms. Empirical and nonparametric methods of survival-curve estimation, graphical methods. Classical, likelihood, and Bayesian inference in parametric models. Survival regression models: proportional and nonproportional hazards models. Accelerated failure time models. Stochastic mechanisms inducing lifetime distributions. Multivariate failures. Competing risks. Multivariate exponential, and other distributions. Mixtures of failure time distributions. Applications in medicine, engineering, economics. Prerequisites: Statistics 215 and 216. 3 units. *Parmigiani, West, or Wolpert*



**376. Advanced Modeling and Scientific Computing.** An introduction to advanced statistical modeling and modern numerical methods useful in implementing statistical procedures for data analysis, model exploration, inference, and prediction. Topics include simulation techniques for maximization and integration. Prerequisite: Computer Science 221 or equivalent. 3 units. *Müller*

**381. Nonlinear Regression.** Likelihood and Bayesian approaches to model identification (or parameter estimation) and prediction in nonlinear models. Numerical solution of nonlinear optimization problems with and without constraints: derivative-free methods, quasi-Newton methods, successive quadratic programming, stochastic methods (simulated annealing, genetic algorithms). Conditioning, convergence, identifiability problems. Model selection and validation. Applications include growth models, PDE models, pharmacokinetic models. Prerequisites: Statistics 216 and 376 or equivalent. 3 units. *Staff*

**386. Noncooperative Game Theory.** See C-L: Economics 315; also C-L: Political Science 315. 3 units. *Moulin*

**390. Statistical Consulting Workshop.** Under faculty supervision, students address and solve consulting problems submitted to ISDS's campus-wide consulting program, and present their solutions to the class. May be taken more than once. Consent of instructor required. 1 unit. *Lavine*

**395. Readings in Statistical Science.** Advanced seminar on topics at research frontiers in statistical sciences. Consent of instructor required. 3 units. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**203S. Senior Seminar in Statistics**

**298. Topics in Probability Theory**

### **The Master of Arts in Teaching Program**

Diane Sasson, Ph.D., *Director*

The Master of Arts in Teaching program (MAT) is designed for talented liberal arts graduates who wish to teach their discipline in secondary schools. The MAT degree requires 36 units of graduate credit, consisting of 18 units (six courses) within the student's discipline, six units (two courses) of MAT-specific education courses, and twelve units devoted to a year-long internship/seminar. The program is open to students with strong undergraduate preparation in English, mathematics, the sciences, social studies, or Latin.

More information on the program is available from Dr. Sasson, MAT Director, 138 Social Sciences Building, Box 90093, Duke University, Durham, North Carolina 27706.

**302. Educating Adolescents.** Focus on understanding the adolescent as a learner. Study of selected theories of adolescent development and theories and principles of educational psychology emphasizing secondary education. Open only to MAT students. 3 units. *Bingham*

**303. Effective Teaching Strategies.** During the first part of the course students learn general teaching strategies for secondary classrooms such as time management, student behavior management, planning for instruction, instructional presentation, designing effective lessons, feedback, promoting critical thinking skills, and cooperative learning. In the second part students work on methodologies in specific subject area groups. Open only to MAT students. 3 units. *Teasley*

**341. Internship and Reflective Practice.** During fall semester MAT students are placed in supervised internships in local high schools under the direction of trained and certified mentor teachers. The accompanying seminar provides students with an understanding of the adolescent as learner, and opportunities for directed reflection on themselves as teachers and learners, and their students as learners. Open only to MAT students. 6 units. *Staff*

**342. Internship and Content Methodology.** The internship continues through second semester under the supervision and coaching of the mentor. The seminar brings together interns, high school teachers, and content faculty members in specific subject area groups to explore emerging knowledge in the discipline, and the ways that knowledge is best delivered in the high school classroom. Open only to MAT students. 6 units. *Staff*

## The University Program in Toxicology

Professor Graham, *Director* (M255 Davison Building); Professor Abou-Donia, *Deputy Director and Director of Graduate Studies* (020 Research Park IV)

The University Program in Toxicology seeks to provide students with a sound theoretical base for a career in environmental toxicology and thorough laboratory training in experimental toxicology. This interdepartmental program brings together students, postdoctoral fellows, and faculty members from various scientific disciplines to interact in the examination of toxicological problems. Faculty members are aligned with one or more of the following subdisciplines of toxicology: neurotoxicology, the toxicology of oxidative stress, and cell and molecular toxicology. Within cell and molecular toxicology are faculty members with expertise in cancer biology, immunotoxicology, biological toxins, and the reaction of toxicants with cellular macromolecules.

The program faculty is comprised of members from the Departments of Biochemistry, Cell Biology, Chemistry, Microbiology, Neurobiology, Pathology, Pharmacology, and the School of the Environment, including the Duke University Marine Laboratory.

Students seeking a Ph.D. in one of the participating Graduate School departments must make initial application to that department. Students who apply initially for graduate study in one of the departments may also be nominated by that department for admission to the program. Such students should list toxicology as their "Special Field" on the application form. It is expected that most students will have a strong undergraduate preparation in mathematics and the physical and biological sciences with demonstrated excellence of performance as judged by grades in course work and letters of recommendation from former instructors. Each student in the program will take a series of courses in toxicology as well as courses specified by his or her department. A student will be expected to choose a dissertation advisor in his or her department at least by the end of the first two semesters in the program, and will normally be expected to begin dissertation research during the third semester in residence. Upon satisfactorily completing all degree requirements in the program and in the department, students will be jointly recommended for the Ph.D. degree.

Further information may be obtained from the director of the Toxicology Program.

## Women's Studies

Professor of the Practice and Adjunct Professor Jean F. O'Barr, *Director* (210 East Duke Building); Professor Carol Meyers, *Associate Director*; Professor Hamilton; Assistant Professor of the Practice Rudy

Graduate and professional students enrolled at Duke University are encouraged to participate in the Women's Studies Program. Participation includes doing graduate level



work in women's studies courses, earning a graduate certificate in women's studies, conducting research on gender-related topics, selecting feminist theory and/or women's studies as a prelim area, writing master's and doctoral theses in feminist scholarship, participating in a monthly dissertation writer's seminar, joining a community of advanced graduate students called Women's Studies Scholars, teaching courses on women, gender, and feminist theories, and attending lectures, seminars, conferences, discussion groups, and other campus events sponsored by the program.

Graduate students affiliate with the program by submitting, in writing, their intention to take courses and do research on women and gender systems during the course of their studies here. Affiliated students are put on the mailing list and receive calendars, newsletters, lecture notices, and invitations to special events. An annual research conference organized by students affiliated with the program is held each year. Information on participation is available in the office.

Graduate work in women's studies takes place both in interdisciplinary seminars and in courses offered through departments. In addition to these possibilities, graduate students are encouraged to develop independent study courses, either with a member of the faculty affiliated with women's studies or in conjunction with the courses offered through the undergraduate Women's Studies Program.

The Women's Studies Program offers a certificate to qualified students in A.M., Ph.D., and professional degree programs of the university. To qualify for the graduate certificate, students must pass a minimum of three graduate level courses on women and gender. The graduate core courses in Women's Studies—WST 211S, WST 212S, WST 213S, and WST 214S—are described below. Any one of the four fulfills the core course requirement for the graduate certificate. The second and third courses are chosen by the student from departmental offerings to build on their disciplinary training and demonstrate a breadth and depth of knowledge about women, culture, and society. Students' course plans are approved by the Women's Studies Steering Committee as early as possible in their graduate careers. Students in the Divinity School and those earning an A.M. in Liberal Studies have individualized graduate certificate requirements and need to consult the director. The award of the graduate certificate in women's studies is carried on the student's official university transcript upon completion of the work. A recognition ceremony is held each September for students who have earned the certificate.

**211S. Women's Studies: Intellectual and Institutional Foundations.** An interdisciplinary overview of feminist theorists prior to the twentieth century and of the rise of feminist scholarship in the disciplines. Consideration of the institutional origins and characteristics of Women's Studies and the future contours of feminist scholarship. 3 units. *O'Barr, Rudy, and staff*

**212S. History and Theory of Feminism: The Beginnings.** An interdisciplinary investigation of selected writings by women about the evolution of women's social and cultural positions in primary and secondary sources. Sources include those of antiquity and the Middle Ages although the emphasis is on writings from the Enlightenment through the early twentieth century, including liberal feminist and materialist feminist thought. 3 units. *O'Barr, Rudy, and staff*

**213S. History and Theory of Feminism: From 1960s to the Present.** An interdisciplinary investigation of feminist theories from the mid-twentieth century to the present using primary and secondary sources. Emphasis on the multiplicities of feminist thought and the incorporation of theorists on a global basis. 3 units. *O'Barr, Rudy, and staff*

**214S. History and Theory of Feminism: Institutional Issues.** An interdisciplinary investigation of the history of the education of women and the evolution of women's studies as an academic discipline. Examination of the relationships between gender and



the academy with an emphasis on the changing patterns of higher education, including feminist pedagogy and epistemology. 3 units. *O'Barr*

**284S. Feminist Theory and the Social Sciences.** Examination of feminist modes of inquiry in the social sciences. The relationship of gender in economic, political, social, and cultural systems and the resulting methodological shifts in social science disciplines. C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Psychology: Social and Health Sciences 284S, and Sociology 284S. 3 units. *Chafe, Hamilton, Neuschel, O'Rand, or Spinner*

**391, 392. Tutorial in Special Topics.** Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units each. *Staff*

## COURSES CURRENTLY UNSCHEDULED

### 283S. Feminist Theory and the Humanities

## COURSES ON WOMEN OFFERED BY DEPARTMENTS AND PROFESSIONAL SCHOOLS

Christian Education 255. History of Women in Methodism. *Felton*  
Christian Theology 214. Feminist Theology. *McClintock-Fulkerson*  
Cultural Anthropology 215S. The Anthropology of Gender: Theoretical Issues. *Luttrell, Quinn, Silberblatt, or Starn*  
Cultural Anthropology 216S. Gender, Race, and Class. *Luttrell*  
Economics 208S. Economics of the Family. *McElroy*  
English 269. American Women Writers. *C. Davidson, Pope, or Tompkins*  
English 288. Western in American Culture. *Tompkins*  
English 321. Gender and Power in Renaissance Texts. *DeNeef*  
English 381. Sex/Gender/Representation: Gay and Lesbian Literary Traditions. *Moon and Sedgewick*  
English 381. Ways of Knowing. *Torgovnick*  
French 290S. Studies in a Contemporary Figure: Wittig. *Orr*  
French 391. French Seminar: Autobiography. *Kaplan*  
French 391. French Seminar: The Epistolary Genre. *Longino*  
German 254S. Literature by Women. *Rasmussen*  
German 275S. German Women Writers. *Rasmussen*  
History 221. Gender and the State in Early Modern Europe. *Neuschel*  
History 227-228. Recent United States History: Major Political and Social Movements. *Chafe*  
History 351. Colloquium in Women's History. *Staff*  
Law 335. Family Law. *Bartlett*  
Law 529. Feminist Legal Theory. *Morris*  
Literature 254. Introduction to Feminism. *Moi or Radway*  
Literature 284. Intellectual as Writer: Simone de Beauvoir. *Moi*  
Literature 289. Topics in Feminist Theory. *Moi, Radway, or Tompkins*  
Philosophy 203S. Contemporary Ethical Theories. *Lind*  
Political Science 299. Feminist Political Theory. *Curtis*  
Psychology 208S. Emotion. *Fredrickson*  
Psychology 264S. Gender, Hormones, and Health. *J. Hamilton*  
Religion 234. Early Christian Asceticism. *Clark*  
Religion 253. Feminist Theory and the Study of Christianity. *Clark and McClintock-Fulkerson*  
Russian 214. Gender, Nationalities, and Russian Literary Traditions. *Gheith*

## Zoology

Professor H. Nijhout, *Chair* (105 Biological Sciences); Professor Tucker, *Director of Graduate Studies* (107-B Biological Sciences); Professors Barber, Forward, Gillham, Klopfer, Laurie, Livingstone, McClay, Nicklas, Rausher, Simons, Staddon, Terborgh, Uyenoyama, Vogel, Wainwright, and Ward; Associate Professors Brandon, Nowicki, Rittschof, Roth, and K. Smith; Assistant Professors Crenshaw, Cunningham, Fehon, and Morris; Professors Emeriti Bailey, Bookhout, Fluke, Gregg, and Schmidt-Nielsen; Adjunct Professor Schmidt-Koenig; Adjunct Associate Professor M. Nijhout

The Department of Zoology manages a variety of programs tailored to individual needs of students seeking the Ph.D. degree. A master's degree may be taken by students en route to the Ph.D., or by those who leave the doctoral program. Ordinarily, only students seeking the doctorate are admitted to the department. In general, students entering the department will be equipped to pursue advanced degrees if they have completed an undergraduate major in biology along with some formal training in college level chemistry, mathematics, physics, and foreign languages. A reading knowledge of one foreign language is required of all doctoral students in zoology.

Nevertheless, in recognition and support of the modern trend toward interdisciplinary research, the department is prepared to accept promising students with less orthodox academic backgrounds and is ready to encourage any student wishing to undertake a program of study leading, in effect, to an interdisciplinary degree sponsored by the department.

Thus, all students are urged to search widely in both the *Bulletin of Duke University: Undergraduate Instruction* and the *Bulletin of Duke University: Graduate School* for information about the intellectual resources of the university. Special attention should be given to announcements of the Departments of Biochemistry, Biological Anthropology and Anatomy, Botany, Cell Biology, Chemistry, Cultural Anthropology, Geology, History, Immunology, Mathematics, Microbiology, Pharmacology, Philosophy, Psychology, Sociology, and Zoology; announcements of the School of Engineering and the School of the Environment should also be consulted.

### For Seniors and Graduates

The L suffix on a zoology course number indicates that the course includes a laboratory.

**201L, S. Animal Behavior.** Survey of past developments and current controversies in animal behavior. Extensive readings, followed by individual experimental or descriptive projects in the laboratory or field (or Primate Center). Recommended background: Biology 21L and 22L, Biology 151L, and statistics, or equivalents. 4 units. *Klopfer*

**203L, Marine Ecology.** Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. Four units (fall and spring); six units (summer). (Given at Beaufort.) Prerequisite: none: suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Environment 219L and Marine Sciences. Variable credit. *Kirby-Smith*

**206S, Controversies in Biology.** A contentious theme for reading, discussion, and an individual or joint paper. Illustrative past topics: the nature of the creative process, causality in biological thought, the lack of political impact of many scientific developments. Open to nonmajors. 3 units. *Klopfer*

**213L, Behavioral Ecology.** How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. (Given at Beaufort.) Prerequisites: introductory biology (Biology 21L and 22L). C-L: Marine Sciences. 6 units. *Rubenstein (visiting summer faculty)*

**215, Tropical Ecology.** Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Botany 215 and Environment 217. 3 units. *Terborgh*



**216L. Limnology.** Lakes, ponds, and streams; their origin, development, geochemistry, energy balance, productivity, and the dynamics of plant and animal communities. Laboratory includes field trips. Offered biennially. Prerequisites: Biology 21L and 22L, and Chemistry 12L and Mathematics 32 and physics; or equivalents; or consent of instructor. 4 units. *Livingstone*

**229L, S. Paleocology.** Global change over the last two million years. Prerequisites: two semesters of biology or geology; and one semester each of calculus, chemistry, and physics; or consent of instructors. C-L: Botany 229L. 3 units. *Bush, Clark, and Livingstone*

**234S. Problems in the Philosophy of Biology.** Consent of instructor required. See C-L: Philosophy 234S; also C-L: Botany 234S. 3 units. *Brandon*

**237L. Systematic Biology.** Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L and 22L or equivalents. C-L: Botany 237L. 3 units. *Staff*

**244. Principles of Immunology.** Prerequisites: Biology 160 and Chemistry 151L or equivalents. See C-L: Immunology 244. 3 units. *Kostyu, McClay, and staff*

**249. Comparative Biomechanics.** The structure and operation of organisms in relation to the mechanics of solids and fluids, including readings from the primary literature. Not open to students who have taken Biology 149. Prerequisites: Mathematics 31 and Physics 51L or equivalents. 3 units. *Vogel and Wainwright*

**258L. Introduction to Modern Microscopy.** A hands-on approach to teach students how to use the new microscopy with an emphasis on the principles underlying their application. 3 units. *Crenshaw*

**262. Biology of Parasitism.** How parasites, from viruses through vertebrates, have solved the special problems associated with their dependence on other organisms. Emphasis on life cycles, host-parasite interactions, and experimental parasitology. Prerequisites: Biology 22L and 160 or equivalents. 3 units. *M. Nijhout*

**263. Molecular Genetics of Drosophila Development.** Consent of instructor required. See C-L: Cell Biology 263; also C-L: The University Program in Genetics 263. 2 units. *Fehon, Kiehart, and Wharton*

**267L. Community Ecology.** Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Botany 267L. 3 units. *Clark*

**269. Advanced Cell Biology.** Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of instructor. C-L: Botany 269, Cell Biology 269, and Immunology 269. 3 units. *Siedow and staff*

**274L. Biology of Marine Invertebrates.** Systematic survey of the principal marine invertebrate taxa, with emphasis on structure, function, behavior, and ecology. Field trips and independent projects. Not open to undergraduates who have taken Biology 176L. (Given at Beaufort.) Prerequisites: introductory biology (Biology 21L and 22L). C-L: Environment 297L and Marine Sciences. 6 units. *Dimock (visiting summer faculty)*

**281. DNA, Chromosomes, and Evolution.** The relationship of chromosome and DNA-sequence organization with evolution; karyotype changes and speciation; repetitive DNA, split genes, transposable elements, and evolutionary mechanisms; phylogeny reconstruction; evolution of mitosis and the chromosome cycle. Prerequisite: an



introductory course in genetics or cell or molecular biology, or consent of instructor. C-L: The University Program in Genetics 281. 3 units. *Laurie and Nicklas*

**283. Molecular Genetics of Organelles.** Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: Botany 283 and The University Program in Genetics 283. 3 units. *Boynston (botany) and Gillham*

**284. Molecular Population Genetics.** Theoretical and computational basis of evolutionary biology at the sequence level. Models of nucleotide and amino acid substitution; distance measures; distance methods for phylogeny reconstruction; tests of neutrality, adaptive selection, and hitchhiking; methods for distinguishing between common ancestry and adaptation; case histories of molecular evolution. For graduate students and upper-level undergraduates with coursework in genetics or evolution or mathematics. 3 units. *Uyenoyama*

**286. Evolutionary Mechanisms.** Prerequisites: Biology 21L and 22L, and Biology 180 or equivalents. See C-L: Botany 286; also C-L: The University Program in Genetics 286. 3 units. *Antonovics (botany), Rausher, and Uyenoyama*

**287S. Macroevolution.** Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biological Anthropology and Anatomy 287S and Botany 287S. 3 units. *Roth*

**288. Mathematical Population Genetics.** Principles of formulation and analysis of dynamic mathematical models of genetic evolution. Rotating topics include: mating systems, sex ratio, stochastic processes. Prerequisites: calculus; statistics and linear algebra recommended. C-L: The University Program in Genetics 288. 3 units. *Uyenoyama*

**289L. Methods in Morphometrics.** Techniques for the acquisition and analysis of quantitative data for describing and comparing biological form. Topics include: image capture and analysis, two- and three-dimensional digitization, and multivariate and geometric techniques such as allometric analysis, outline and landmark-superposition methods, and deformation models. Background in statistics and linear algebra recommended. 4 units. *Mercer*

**290. Pattern and Process in Vertebrate Development.** Prerequisites: course in comparative or human anatomy and consent of instructor. See C-L: Biological Anthropology and Anatomy 290. 3 units. *Smith*

**291. Mathematical Biology.** An introduction to mathematical biology. Topics drawn from population biology, epidemiology, enzyme kinetics, chemotaxis, and developmental biology. Emphasis on robust methods for obtaining useful information from biological models. Methods include graphical, geometric, perturbation, and stability analysis. Prerequisite: Mathematics 103 or equivalent. 3 units. *Mercer*

**295S, 296S. Seminar.** Topics, instructors, and course credits announced each semester. Variable credit. *Staff*

#### **For Graduates**

**325S, 326S. Developmental, Cellular, and Molecular Biology Seminar.** Weekly presentations in developmental, cellular, and molecular biology topics by students, faculty, and invited speakers. Consent of instructor required. 1 unit each. *Staff*

**353, 354. Research.** To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. C-L: Marine Sciences. Variable credit. *Staff*

**360, 361. Tutorials.** An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. Hours and credit to be arranged. Variable credit. *Staff*

**364. Ungraded Research.** To be carried on under the direction of the appropriate faculty members. Hours to be arranged. Variable credit. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**222L. Entomology**

**355, 356. Seminar**

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## *Special Study Centers, Programs, and Opportunities*





## **Center for the Study of Aging and Human Development**

The center is a multidisciplinary program devoted to research, training, and clinical activities in gerontology and geriatrics. Although the center does not offer degrees, the varied programs, research laboratories, and clinical settings provide a context and resource for undergraduate and graduate students and for health professionals with special interests in adult development and aging. The center conducts multidisciplinary, two-year programs for postdoctoral fellows interested in focused training for independent research on many varied aspects of aging and adult development. Resources of this all-university program include data from two longitudinal studies, a wide range of archival data of special interest to social scientists, a human subjects registry, and the center's basic and applied research laboratories. A division of geriatrics coordinates research, training, and services related to the care of older adults. Undergraduate and graduate students of the University are welcome to inquire about participation in all programs at the center. Inquiries should be addressed to Harvey Jay Cohen, M.D., Director, Duke University Center for the Study of Aging and Human Development, Box 3003, Duke University Medical Center, Durham, North Carolina 27710.

## **Asian/Pacific Studies Institute**

The institute sponsors an agenda of visiting speakers and scholars and coordinates study abroad programs in China and Japan. A limited number of fellowships are granted which provide stipends for a two-year period. Incoming graduate students with the Ph.D. as their objective, students in good standing in the first year of study in Duke professional schools, and current Duke students enrolled in Ph.D. programs may be considered for these fellowships. Additional one-year fellowships are available. Further information may be obtained from the Asian/Pacific Studies Institute, 2111 Campus Drive, Box 90411, Duke University, Durham, North Carolina 27708-0411.

## **University Program in Biological Chemistry**

The University Program in Biological Chemistry is designed to provide training to students in synthetic and mechanistic aspects of the interface between chemistry and biology. Specializations include carbohydrate, lipid, nucleic acid, and protein synthesis; molecular recognition between biomolecules; and mechanisms of catalytic processes involving proteins and nucleic acids and their associated cofactors. Course offerings, including a core focusing on the synthesis of biological macromolecules and mechanisms of enzymatic cofactors, are aimed at providing significant cross-training between

chemistry and biology and developing a common language among students in different disciplines. Intensive laboratory rotations begin in the summer and continue in the fall and (in some cases) spring semesters of the first year of study. The research laboratories of program faculty are well-funded and use state-of-the-art equipment for magnetic resonance, mass spectrometry, and computer graphics, among others.

Students may apply and be admitted directly to the University Program in Biological Chemistry or may apply to one of the component departments (Chemistry, Biochemistry, Botany) with a request to be considered by the program. For more information contact the Director of Graduate Studies, University Program in Biological Chemistry, Duke University, Box 90354, Durham, NC 27708-0354.

## **Center for Cellular and Biosurface Engineering**

The Center for Cellular and Biosurface Engineering (CCBE) is a multidisciplinary educational and research program for engineers and scientists. It focuses upon application of the methods and perspectives of engineering to the study of molecules, cells, tissues, and surfaces. This includes a subdiscipline of biotechnology involving the rational manipulation of surfaces to alter cellular and protein function. The program includes faculty from the Departments or Divisions of Biochemistry, Biomedical Engineering, Cell Biology, Chemistry, Electrical Engineering, Medicine, Mechanical Engineering and Materials Science, Neurobiology, Obstetrics and Gynecology, Ophthalmology, Orthopaedic Surgery, Physics, Radiation Oncology, and Zoology. Participating faculty are a select but diverse group of experts in a wide range of fields, and all conduct research in which cellular and biosurface engineering plays a central role.

Students apply for graduate study to participating departments and are subject to the degree requirements of the university and these home departments. The Center for Cellular and Biosurface Engineering has petitioned the Graduate School for formal approval to offer a certificate of graduate study. If approved, the requirements for the certificate include completion of four core courses, participation in a seminar series and in an industrial internship program. A limited number of fellowships are granted, providing stipend and tuition support.

For additional information contact the Center for Cellular and Biosurface Engineering, B-212 Levine Science Research Center, Box 91010, Duke University, Durham, North Carolina 27708-1010.

## **Canadian Studies Program**

The Canadian Studies program offers a certificate of graduate study. The requirements for the certificate include completion of three Canadian Studies courses, including the core course, Interdisciplinary Studies Course 282, Canadian Issues. The other two courses may be from existing courses, or from independent studies with the center's faculty. In addition, the dissertation must be written on a Canadian or Canadian-comparative topic. The student must also demonstrate a knowledge of French or one of Canada's aboriginal languages.

The purpose of the Canadian Studies Program is to formalize and expand the interest of graduate students in Canada, to introduce the study of Canadian life and culture at the undergraduate level, and to encourage such study in primary and secondary schools.

The program awards a limited number of foreign language and area studies graduate fellowships and teaching assistantships for the study of Canada to American residents. Fellows must work on a Canadian or Canadian/comparative dissertation topic within their disciplines and must also study French. Grants of travel aid for field research in Canada are also offered.





Inquiries should be addressed to the Director, Canadian Studies Center, Duke University, Box 90422, Durham, North Carolina 27708-0422.

## **Center for Documentary Studies**

This interdisciplinary center for research, teaching, and the dissemination of documentary work is dedicated to encouraging and supporting the work of photographers, filmmakers, historians, journalists, novelists, and others who work by direct observation and participation in the lives of individuals and communities. The center's graduate-level research focuses on a collaborative research project entitled "Behind the Veil: African American Life in the Jim Crow South," directed by professors William Chafe and Raymond Gavins of the History Department. The center emphasizes documentary fieldwork and encourages students to become engaged in documentary projects in communities outside the university. Graduate students may participate in a variety of courses and programs that the center offers under the auspices of several Duke departments including History, Public Policy Studies, Education, and English. Center-sponsored projects offer a limited number of assistantships to graduate students in the arts and humanities. For more information contact Iris Tillman Hill, Director, Center for Documentary Studies, Lyndhurst House 1317 West Pettigrew Street, Box 90802, Durham, North Carolina 27708-0802.

## **Center for Health Policy Research and Education**

The Center for Health Policy Research and Education provides a focal point at Duke for educational activities in health policy. The center faculty focus their scholarly work on health policy development and implementation, and the center supports the Duke community by facilitating academic collaboration and by providing consulting services to the Duke University Medical Center. Address inquiries to David B. Matchar, M.D., Director, Center for Health Policy Research and Education, 125 Old Chemistry Building, Durham, North Carolina 27706.

## **Center for International Development Research**

The Center for International Development Research (CIDR) is one of several active research and training facilities in Duke's Terry Sanford Institute of Public Policy. The center's core faculty are drawn from a variety of academic disciplines, including economics, political science, environmental studies, public policy, business administration, and history. The faculty's teaching, research, and consulting experience are international in scope, encompassing a broad range of development policy issues.

The center offers both long- and short-term programs of study, including the Program in International Development Policy (PIDP). The PIDP provides from one semester to two years of training in policy analysis and problems related to sustainable economic development. Professionals with several years' experience as practitioners or applied researchers in a development-related field are eligible to apply to the program. For additional information, contact the Center for International Development Research, Duke University, Box 90237, Durham, North Carolina 27708-0237.

## **Center for International Studies**

This center is one of the major coordinating units in the university which stimulates dialogue and research on global issues. The center sponsors a number of faculty committees on major world regions and on transnational analytical themes. As a U.S. Department of Education National Resource Center in International Studies, the center funds a series of courses on global issues of interest to graduate students. These courses, provide opportunities for teaching assistantships for graduate students in the humani-

ties and social sciences. In addition, the center sponsors a program of awards for graduate students who wish to undertake research abroad. For more information contact Dr. Josefina C. Tiryakian, Senior Coordinator of Programs, Center for International Studies, 2122 Campus Drive, Box 90404, Durham, North Carolina 27708-0404.

## **Center for Mathematics and Computation in Life Sciences and Medicine**

The Center for Mathematics and Computation in Life Sciences and Medicine was established in 1986 to meet the growing need for quantitative methods in the understanding of complex biological and medical systems. Many important research problems, both basic and applied, now require the collaboration of experimental biologists, mathematicians, and computer scientists. The purpose of the center is to facilitate such collaborations between researchers in different departments and institutions, as well as between academic and industrial laboratories. Address inquiries to Professor Michael C. Reed, Director, Center for Mathematics and Computation in Life Sciences and Medicine, Department of Mathematics, Duke University, Box 90320, Durham, North Carolina 27708-0320.

## **Center for Slavic, Eurasian, and East European Studies**

The graduate school of Duke University offers a program leading to the A.M. and Ph.D. degrees in several disciplines (economics, history, literature, linguistics, and political science), with a concentration in Slavic and East European studies. Students are encouraged to utilize the libraries and facilities of both Duke and the University of North Carolina at Chapel Hill. The holdings of the two libraries in Russian and East European materials are substantial and complementary. Both libraries have a policy of purchasing all significant published works in Slavic history, economics, government, geography, literature, and linguistics. Other joint activities include periodic colloquia involving the personnel of the two institutions and distinguished visiting scholars.

Students must apply to the director of graduate studies in the department of the discipline in which they wish to specialize. The center administers a limited number of graduate fellowships, and offers an area studies certificate.

For more information, contact Professor Edna Andrews or Vladimir Treml, co-directors, Center for Slavic, Eurasian, and East European Studies, Center for International Studies, 2122 Campus Drive, Box 90260, Duke University, Durham, North Carolina 27708-0260.

## **Center for Tropical Conservation**

The Center for Tropical Conservation was established to focus the activities of Duke faculty who share a common concern for the human and environmental problems of the tropics. Disciplines represented include, among others, anthropology, botany, economics, forestry, history, political science, and zoology. The center serves to sponsor interdisciplinary courses, seminars, and workshops; to promote and coordinate research relevant to the sustainable development of natural resources; and to gather and disseminate pertinent information. Inquiries should be addressed to Professor John W. Terborgh, Director, Center for Tropical Conservation, 3705-C Erwin Road, Simons Building, P.O. Box 90381, Durham, North Carolina 27708-0381.

## **Center for Demographic Studies**

The center promotes research and training in demographic studies. Its facilities, located at 2117 Campus Drive, include a population library, the Joseph J. Spengler Collection of publications and research materials, and extensive data resources. The center does not offer degrees; it promotes the pursuit of advanced degrees, with a



specialization in population studies, through either the Department of Sociology or the Department of Economics. Predoctoral and postdoctoral fellowships are available from the National Institute on Aging sponsored training program in the Social and Medical Demography of Aging. The center's program provides opportunities for direct student participation in ongoing research projects. The program of extramural research stresses, but is not limited to, work in the demography of aging, health, mortality, fertility, and migration.

Inquiries for training opportunities may be directed to Dr. George C. Myers, Director, Center for Demographic Studies, 2117 Campus Drive, Box 90408, Durham, North Carolina 27708-0408.

## **Program for the Study of Developed Shorelines**

The Program for the Study of Developed Shorelines was established in recognition of a critical need for both academic programs and geological research on national coastal issues. The goal of the program is promotion of research, education, and publication concerned with oceanic shorelines already under development. A limited number of graduate research fellowships are available to both M.S. and Ph.D. candidates and postdoctoral support is available for individuals involved in appropriate research. The program is centered both within the Department of Geology and the School of the Environment. Fellows supported by the program must satisfy all departmental requirements. For more information contact Professor Orrin Pilkey, Director, Program for the Study of Developed Shorelines, Department of Geology, Duke University, Box 90228, Durham, North Carolina 27708-0228.

## **Program in International Development Policy**

The Program in International Development Policy (PIDP) is offered through the Center for International Development Research at Duke's Sanford Institute of Public Policy. The PIDP provides from one semester to two years of training in policy analysis and problems related to sustainable economic development. Most participants in the program—known as PIDP Fellows—have at least five years' experience as practitioners or applied researchers in a development related field. They represent diverse nationalities, academic interests, and professional backgrounds.

The PIDP admits both degree and non-degree (that is, certificate) paraticipants. Degree candidates normally spend two academic years fulfilling the requirements for the Master of Arts in Development Policy. Participants with a significant amount of previous graduate-level course work may be eligible to complete the M.A. in one year. Limited scholarships are available. For further information and application materials, contact the Program in International Development Policy, Duke University, Box 90237, Durham, North Carolina, 27708-0237.

## **Council on Latin American Studies**

The Council on Latin American Studies oversees and coordinates graduate education in Latin American studies, and promotes research and dissemination of knowledge about the region. Chaired by Professor Daniel James, the council is made up of Latin Americanist faculty and staff members representing Arts and Sciences disciplines as well as the professional schools. The council sponsors a speakers series which ne provides a forum for presentations by visiting Latin Americanists from throughout the U.S. and overseas, as well as Duke and UNC faculty and graduate students. Each year the council also cosponsors a number of conferences and other special events, including the annual Latin American Labor History Conference.

The council and the Graduate School offer a certificate in Latin American Studies to student in M.A. and Ph.D. programs who fulfill the following specific academic requirements:



1. six graduate courses on Latin America;
2. an approved thesis prospectus or departmental equivalent on a Latin American topic; and
3. a working knowledge of Spanish, Portuguese, or other language of Latin America or the Caribbean, such as Yucatec Maya, Quechua, Haitian Creole, etc.

For additional information about Latin American Studies at Duke and courses with Latin American content offered by departments, see the section on "Courses of Instruction" in this bulletin.) Graduate students interested in obtaining a certificate in Latin American Studies should contact the Council Chair or Program Coordinator, Council on Latin American Studies, 2114 Campus Drive, Box 90255, Duke University, Durham, NC 27708-0255, telephone (919) 681-3980, email: las@acpub.duke.edu.

## Program in Political Economy

The Graduate School offers a Certificate in Political Economy. The certificate is awarded to graduate students in the Departments of Economics and Political Science who successfully complete a series of courses designed to provide interdisciplinary training. Completion of the certificate should enable a student to teach and conduct research in the field of political economy. Work in this field should also be sufficiently compatible with the student's departmental training to enable students to present themselves on the market with the disciplinary credentials to secure an academic appointment.

To earn the Certificate in Political Economy, a student must successfully complete a minimum of five courses, three of which are to be drawn from the core courses and two from a specialized area. One of the three core courses and two of the five courses overall must be in economics, taken in the Department of Economics, the Fuqua School of Business, or the Institute of Public Policy. All of these courses must be at the graduate level, unless an exception is approved by the program director.

All students seeking the certificate are also required to complete successfully at least two courses within the following fields of specialization: Individual and Social Choice; Normative Political Theory and the History of Economic Thought; and Governments and Markets.

For additional information, contact Professor John Aldrich or Professor Hervé Moulin, Duke University, Department of Political Science, 214 Perkins Library, Durham NC 27708-90204, 919/660-4300.

## Medical Historian Training Program

The Medical Historian Training Program is conducted under the auspices of the School of Medicine and the Graduate School. The M.D.-Ph.D. program requires a minimum of six years of graduate and medical study, and the M.D.-A.M. four or five years, depending on the use of summer terms. The M.D.-Ph.D. program is intended for those students who know that their major career effort will be in teaching and other scholarly activities in the history of medicine (not necessarily to the total exclusion of clinical medicine). The M.D.-A.M., on the other hand, is appropriate for those who are undecided, but who wish to acquire a firm foundation for future study. In both programs the first two years and the last year will be spent in the medical school. All requirements for the Ph.D. and the A.M. must be completed before the final year of the M.D. program.

**Application and Admission Procedures.** Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History including the MCAT and GRE exams. Those candidates holding the M.D. degree will be considered for the Ph.D. and the A.M. degrees. Candidates who have completed two years of medical school will also be considered for either degree.

Applicants should complete and submit an application to the Graduate School for admission to the Department of History.

Additional information may be obtained by writing to Dr. Peter English, Box 3675 Duke University Medical Center, Duke University Durham, North Carolina 27710.

## Medical Scientist Training Program

The Medical Scientist Training Program, conducted under the auspices of the Graduate School and the School of Medicine, is designed for students with a strong background in science who are motivated toward a career in the medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the clinical curriculum of the School of Medicine. The program usually requires six to seven years of study and leads to both the M.D. and Ph.D. degrees. Although the special emphasis of this program is on basic medical science, the trainees, because of their education in clinical medicine, have a remarkable range of career opportunities open to them. Graduates of this program generally follow one of two broad paths. Some directly pursue careers in teaching and research in one of the basic medical sciences, while maintaining strong ties with clinical science as a result of their combined training; others enter residency programs before pursuing investigative and teaching careers in clinical medicine, carrying with them strong academic backgrounds in the basic sciences.

**Eligibility.** Applicants must meet the admission requirements of both the Graduate School as a candidate for the Ph.D. degree and the School of Medicine as a candidate for the M.D. degree. Most candidates apply for admission to the first year of the program, but applications are sometimes accepted from students who are enrolled in appropriate stages of their curriculum in the Graduate School or School of Medicine of Duke University. In addition to the minimum requirements for acceptance in the Graduate School and the School of Medicine, advanced course work in science and mathematics as well as prior research experience count heavily in the selection of candidates.

**Financial Support.** Students admitted to the first year of the program can receive a traineeship award, consisting of a stipend and full tuition allowance, provided by a grant from the National Institutes of Health. The present annual stipend is \$12,500. Current policy of the National Institutes of Health limits the duration of the traineeship to six years, but the years need not be consecutive; this permits curricula which take more than six years. For those students requiring more than six years, the department and/or preceptor of the student provide support for additional years in training.

This traineeship, created by the National Research Service Award Act of 1974 (PL 93-348) provides (as do all research training awards under this act) for certain alternate service or payback requirements in the event that a research career is not pursued. Support by the NIH under the National Research Service Award Act requires the recipient to be a citizen or resident of the United States.

**The Training Program.** This program has been designed to offer trainees latitude in the selection of course material. Basic requirements are two academic years composed of the first basic science year and the second clinical science year of the curriculum for medical students at Duke University. Following completion of the second year, the trainee enters the graduate program to complete the requirements for the Ph.D. degree. A final academic year of elective clinical study is necessary to complete the requirements for the M.D. degree. Both degrees are awarded at the completion of this sequence.

Additional information may be obtained by writing Professor Salvatore V. Pizzo, Medical Scientist Training Program, Department of Pathology, Box 3712 Duke University Medical Center, Durham, North Carolina 27710.

## Office of Research Support

The Office of Research Support, located in 02 Allen Building, provides assistance to faculty members who seek external funding for research and other projects and to



graduate students who seek graduate fellowships. The office houses a library of reference materials dealing with external funding. The ORS library contains fellowship and grant information for faculty, postdoctoral fellows, and graduate students from a variety of sources. It is arranged primarily by discipline and also includes such categories as "study abroad" and "dissertation support." Graduate students may take advantage of the resources of the office by browsing through the information on their own or they may make an appointment to talk with the staff by calling 684-3030. The office also reviews all grant proposals submitted to external funding sources, negotiates with the agency, and processes the award. Office hours are from 8:30-5:00 daily.

## **Center for Resource and Environmental Policy Research**

The Center for Resource and Environmental Policy Research at Duke University is committed to the study of public policies on natural resources and the environment. Housed in the School of the Environment, the center promotes and coordinates research by faculty and students in the School of the Environment and other schools and departments at Duke and at other universities to provide a center of excellence for the analysis of contemporary resource and environmental policy issues. The center offers a forum for the examination of public and private responsibilities for natural resources and the environment and provides a means to link the specialized knowledge of academia with the information needs of government, industry, and international agencies.

Among the subjects now under study are corporate environmental policies, valuation of forests and other natural resources, forest policy, and management of tourism in the United States and in developing countries.

For further information, write to the Center for Resource and Environmental Policy Research, Duke University, Box 90328, Durham, North Carolina 27708-0328.

## **Organization for Tropical Studies**

Duke University is a member and the administrative home of an international consortium which provides leadership in education, research, and the wise use of natural resources in the tropics. The basic OTS course, Tropical Biology: An Ecological Approach, lasts for eight weeks (January-March and again in July-August). An eight-week course in Tropical Managed Ecosystems is also offered in July-August, and a three-week course, Tropical Diversity, is conducted in August. Similar courses are conducted in Spanish for Latin Americans.

Application information and forms, as well as fellowship applications for research travel and subsistence are available through the faculty representatives. Consult Professor William Ascher (political science) or Professor Daniel Richter (environment) for information.

## **Center for Research on Women**

The Duke-UNC Center for Research on Women was founded in 1982 as a collaborative endeavor between Duke University and the University of North Carolina at Chapel Hill to promote women's studies scholarship and research throughout the tri-state area of North Carolina, South Carolina, and Virginia; to support curriculum development in women's studies; and to disseminate women's studies research and information throughout the South. The center's principal focus is to explore the interacting dynamics of gender, race, and class, with a particular emphasis on the American South.

The center offers a limited number of unpaid visiting scholar affiliations, and opportunities for graduate student internships. Regular activities include an annual visiting lectureship series; a working paper series, *Southern Women: The Intersection of Race, Class and Gender*, published jointly with the research center at Memphis State



University; the publication of a biannual newsletter, *Branches*; and sponsorship of conferences, colloquia, and community events.

The research center is located at 338 Carr, Building, Box 90719, (919) 684-6641, on the Duke campus, and at 03 Caldwell Hall, C.B.# 3135 at UNC, (919) 966-5787. Dr. Jacquelyn Dowd Hall is the academic director and Christina Greene is the project director.

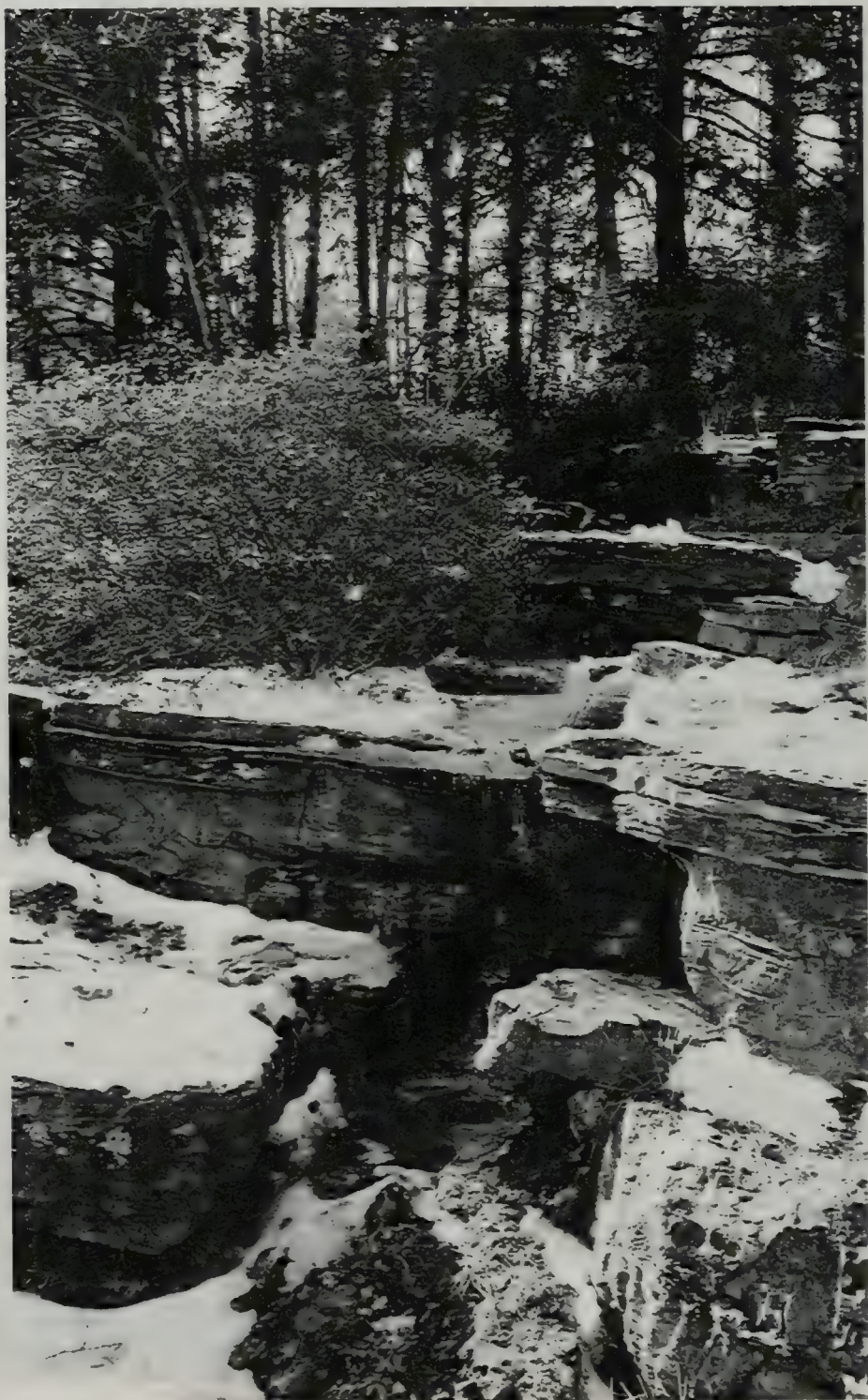
## **Program in Integrative Biology**

The Program in Integrative Biology is an interdepartmental program that encourages students to think broadly and synthetically about problems of interest to biology, and to use the methods and approaches of several different biological disciplines in their solution. The program provides a counterpoise to the increasing narrowness of specialization that has characterized training in many subdisciplines of biology. Breadth of knowledge and an integrative approach to problem solving in such areas as development and evolution, systematics, functional morphology and biomechanics, neurobiology and behavior, and other cross-disciplinary fields, are established by close interaction with participating faculty members and by participation in seminars, workshops, and discussion groups. Graduate students in the program have access to research laboratories of the participating faculty members as well as such research facilities as the Morphometrics Laboratory, the Botany Greenhouses, the Fluid Flow Facility, the Primate Center, the Duke University Marine Laboratory, various vertebrate and invertebrate collections, the Botany Herbarium, the Duke Forest, and the Zoology Field Station. For more information, contact Professor Frederik Nijhout, Program in Integrative Biology, 226 Biological Sciences Building, Duke University, Durham, North Carolina 27706. (919) 684-2507 or (919) 684-3583.





*Resources for Study*





## The Libraries

The libraries of the university consist of the William R. Perkins Library and its seven branches on campus: Biology-Forestry, Chemistry, Lilly, Engineering, Music, Mathematics-Physics, Special Collections; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; and the independently administered libraries of Divinity, Law, Medicine, and Business (Fuqua). As of June 1994, these libraries contained over 4,300,000 volumes. The collection includes 10.9 million manuscripts, and over 2,000,000 public documents.

*The William R. Perkins Library.* The William R. Perkins Library, the main library of the university, houses books, journals, and online resources supporting the humanities and social sciences, as well as a large collection of United States federal and state documents, public documents of many European and Latin American countries. The library is a depository for U.S., North Carolina, and European documents. An international focus is evident throughout the library collections, reflecting the global strengths of area programs at the university. Included are extensive research collections from and about South Asia, Latin America, Africa, Europe, Russia, and Poland, as well as the country's largest collection of Canadiana. The East Asian Collection offers resources in Japanese, Chinese, and Korean on a variety of topics, predominantly history, politics, literature, and language. The newspaper collection includes many eighteenth-century titles; strong holdings of nineteenth-century New England papers; and antebellum and Civil War papers of North Carolina, South Carolina, Virginia, and Georgia; as well as many European and Latin American papers.

The Special Collections Library holdings range from ancient papyri to records of modern advertising. They number more than 200,000 printed volumes and more than 10.9 million items in manuscript and archival collections. They support research in a wide variety of disciplines and programs, including African-American studies, anthropology, classics, economics, history, literature, political science, religion, sociology, and women's studies. Areas of particular strength in the collections include the history and culture of the American South, English and American literature, history of economic theory, British and American Methodism, and the history of modern advertising.

The Circulation/Reserves Department houses the required reading materials placed on reserve for most graduate and undergraduate courses. The department is phasing in campus online access to reserve readings.

The Lilly Library houses the university's principal collections of the visual arts and art history, drama, and philosophy. The Lilly Library is also the location of the Paul B.

Williams Multimedia Broadcast Center. This state-of-the-art facility features remote transmission facilities for the campus as well as the film and videocassette collection. The Music Library, located in Room 113 of the Mary Duke Biddle Music Building, and the Music Media Center, located in Room 027 of the same building, are administered as a single branch library within the Perkins library system. The Music Library contains a rapidly expanding collection of scholarly reference materials, books on music, music scores, and over 200 journals in the field. The Music Media Center has a collection of over 17,000 media items, including compact discs, cassettes, LP recordings, laser discs, and videotapes, plus a collection of over 10,000 microforms, along with various facilities for listening and viewing. The branch libraries serve the academic disciplines bearing their names. The Lilly Library on East Campus, however, contains a small general and reference collection, as well as the university's principal collections of art and art history materials.

The libraries at Duke, the University of North Carolina at Chapel Hill, and North Carolina State University are connected by a computer network. Members of the Duke community can easily and quickly determine what books and other library materials are held by UNC and NCSU. Through a reciprocal borrowing agreement, faculty and students at Duke may borrow materials from both of these libraries.

Reference librarians are on duty in Perkins Library for most of the hours the library is open. Their primary responsibility is to assist patrons in making the most effective use of library collections and facilities. In addition to answering specific questions, the reference librarians also help patrons access information by identifying and explaining the use of library sources and by giving formal and informal instruction to groups of students, faculty, or staff. Professional reference service is available to students in all other campus libraries.

Tours of the Perkins Library are given frequently during Orientation Week and upon request throughout the year. Information about other campus libraries may be obtained from the staff in each of the libraries. The library has both facsimile and copying services. The rules with regard to copyright and a schedule of fees for reproduction services are available in the library at the point of service.

## THE MEDICAL CENTER LIBRARY

The Medical Center Library, located in the Seeley G. Mudd Communications Center and Library Building, provides services and informational resources necessary to further educational, research, and clinical activities in the medical field. In addition to the faculties and students in the Schools of Medicine, Allied Health, and Medical Center graduate departments, the library serves the professional and technical staffs of Duke Hospital as well as other health professionals throughout North Carolina. Over 270,000 volumes are available; approximately 3,000 journal subscriptions are received currently, in addition to extensive back files of older materials. Professional reference librarians are available for assistance in the use of library resources, and arrangements may be made for individual or group tours, instruction, or specialized seminars.

The History of Medicine Collections, including the Josiah C. Trent Collection, consist of rare books and manuscripts and a supporting group of histories, biographies, bibliographies, pictures, and ephemeral materials. The rare books are available to all, but are restricted to library use. Most modern books may be borrowed. The History of Medicine Collections also include the Duke Authors Collection, which preserves an archival copy of each book published by a member of the Duke medical faculty. The Frank Engel Memorial Collection consists of a small group of books for leisure reading in nonmedical subjects, supplemented by several newspapers and popular magazines. A reserve collection of heavily used books and journals is maintained in the Medical Sciences Branch Library located in the Nanaline Duke Building and covers the fields of biochemistry, genetics, pharmacology, and physiology.



## THE SCHOOL OF LAW LIBRARY

The School of Law Library, with over 450,000 volumes, serves both the university and the local legal community. It features comprehensive coverage of basic Anglo-American primary source materials, including nearly all reported decisions of federal and state courts, as well as current and retrospective collections of federal and state codes and session laws. Digests, legal encyclopedias, and other indexing devices provide access to the primary documents. A large section of the library collection is devoted to treatises on all phases of law, as well as history, economics, government, and other social and behavioral sciences relevant to legal research. The treatises are organized in the Library of Congress classification system and are accessible through a public catalog. Special treatise collections are maintained in several subject areas, including the George C. Christie collection in jurisprudence and the Floyd S. Riddick collection of autographed senatorial material. The library is a selective depository for United States government publications, with concentration on congressional and administrative law materials. The library receives the records and briefs from the United States Supreme Court, the Fourth Circuit Court of Appeals, and the North Carolina Supreme Court and Court of Appeals. In addition to its Anglo-American holdings, the library holds substantial research collections in foreign and international law. The foreign law collection is extensive in coverage, with concentrations in European law and business law materials. The international law collection is strong in primary source and treatise material on both private and public international law topics. Undergraduate and graduate students whose course of study requires access to legal literature may use the library. However, access to the library may be restricted during certain times because of accreditation standards.

## UNIVERSITY ARCHIVES

The Duke University Archives, the official archival agency of the university, collects, preserves, and administers the records of the university having continuing administrative or historical value. The institutional archives, which also include published material, photographs, papers of student groups and faculty, and selected memorabilia, are available for research under controlled conditions in 341 Perkins Library.

## Science Laboratories

**Computer ASSIST Center.** For a contemporary university, extensive computing resources are essential. At Duke, the Computer ASSIST Center is the organization that works in partnership with members of the university community to enable them to achieve their goals through computing.

The Computer ASSIST Center supports extensive personal computer and Unix workstation services located throughout the campus. There are six Unix workstation laboratories and clusters containing DEC computers, located in the North, Sociology-Psychology, Biological Sciences, Carr, and Engineering buildings. These workstations are connected to two DEC computer servers and six file servers. There are three laboratories of MS-DOS based personal computers housed in North, Perkins, and West Duke buildings, five other clusters of MS-DOS computers, and nine clusters of Macintosh computers spread throughout the campus. All clusters have dot matrix or laser printers and several are connected to the campus network (DukeNet). While there is a slight charge for use of the laser printers, there is no charge for use of the computers. Free e-mail accounts are available for students from Computer ASSIST.

DukeNet is a fiber optics, backbone network, available in most campus buildings, that provides access to the DEC Unix System, to the Perkins Library online catalog, and to other computing resources, both at Duke and nationwide over the Internet network. DukeNet is managed by Network Communications (NetComm) at Duke. Many under-



graduate dormitory rooms are now wired for DukeNet. DukeNet access is also provided by dialing into a terminal server from a PC with a modem.

Other computing facilities available include mainframe services on an IBM ES/9000 provided by the Duke University Computation Center (DUCC) and supercomputing services on a Cray Y-MP and a Kendall Square KSR-1 parallel computer provided by the North Carolina Supercomputing Center (NCSC).

More specific information regarding Duke computing facilities may be obtained by calling the Computer ASSIST Center Consulting Desk at 660-2983, 9:00 a.m. to 5:00 p.m., Monday through Friday.

**Botanical and Zoological Laboratories.** Facilities for graduate study in the Departments of Botany and Zoology are located on the West Campus together with those of supporting departments (Physics, Chemistry, Geology, and the basic medical sciences). Scientists in Botany and Zoology with common interests are clustered in three buildings. The Biological Sciences building houses systematics, population genetics and evolution, animal physiology and functional morphology; the Duke Phytotron contains plant ecology; and the recently constructed Levine Science Research Center is home for developmental, cellular, and molecular biology as well as the School of the Environment, Computer Science Department, and two basic medical science departments. The three buildings are within in a five-minute walk and maximal interaction occurs between the different groups in Botany and Zoology through seminars, shared instrumentation and collaborative research projects. Special facilities available to botanists and zoologists include animal rooms, greenhouses, darkrooms, refrigerated and controlled environment laboratories, scanning and transmission electron microscopes, a Van de Graaf accelerator, X-ray machines, radiation and radioisotope equipment, a computerized morphometrics laboratory, and other modern research facilities. Extensive facilities for experimentation in environmental control of plant growth are available in the phytotron adjacent to the botany greenhouses.

The herbarium contains approximately 700,000 specimens and includes notable collections of mosses and lichens. Other assets for teaching and research are the Sarah P. Duke Gardens on the West Campus; the eleven-acre experimental plot and field laboratory developed by the Department of Botany; the Duke Forest, comprising 7,700 acres of woodland adjacent to the West Campus; the field station for the study of animal behavior and ecology; and the Duke University School of the Environment Marine Laboratory, an interdepartmental facility located on a small island on the coast at Beaufort, North Carolina, where twenty-two buildings and a small flotilla of ships and boats provide teaching and research facilities for resident graduate students and faculty as well as visiting individuals or groups.

Duke University, through the botany and zoology departments, is a member institution of the Organization for Tropical Studies, Inc., a consortium of universities with field station facilities in Costa Rica that provide opportunities for course work and research in tropical science.

**Highlands Biological Station.** Duke University holds a contributing membership in the Highlands Biological Station at Highlands, North Carolina, on the southern edge of the Blue Ridge Mountains at an elevation of 4,118 feet. The station and the region offer an excellent opportunity for field studies and some laboratory work. A limited number of qualified students in botany and zoology may make arrangements to carry out research here. Scholarships for advanced study during the summer months are available through the station.

For further information contact Dr. M. D. Rausher, Department of Zoology, Duke University, Durham, North Carolina 27706.

**The Phytotron.** The phytotron, a national environmental control facility operated for the National Science Foundation, is adjacent to the Biological Sciences Building and is administered by the botany department. The phytotron is an integrated series of





plant-growth rooms, chambers, and greenhouses, with forty-six separately controlled environments providing more than 4,000 square feet of plant-growing space. The factors of the environment controlled in the units to study plant growth include light, temperature, nutrients, carbon dioxide concentration, and humidity. By using the conditions in various day and night combinations, an exceptionally large number of environments can be simulated for testing the growth responses of plants. The phytotron also includes research laboratories and facilities for studying and monitoring the physiological processes of plants as they respond to global environmental change.

Research space in the phytotron is available to graduate students and faculty at Duke and to members of other educational and research organizations. For information concerning the rental of research space, contact James F. Reynolds, Director of the Phytotron, Department of Botany, Duke University, Durham, North Carolina 27708.

**Duke Forest.** The Duke Forest comprises approximately 7,700 acres of land in five major divisions and several smaller tracts. A ten-minute walk from campus will take one well into many parts of the Durham division, and a network of roads and fire trails make almost all areas of the forest easily accessible.

The forest lies primarily in Durham and Orange counties, near the eastern edge of the piedmont plateau, and supports a cross-section of the woodlands found in the upper coastal plain and lower piedmont of the Southeast. A variety of timber types, plant species, soils, topography, and past land use conditions are represented. Elevations range from 260 to 760 feet. Soils of the region are derived from such diverse parent materials as metamorphic rock of the Carolina slate formation, granite, Triassic sedimentary rock, and basic intrusives.

The forest serves for research in such areas as forestry, zoology, botany, and ecology by faculty and students at Duke and neighboring universities. Background information useful to researchers covers such features as soils, topography, inventory, plantation and cultural records, as well as a bibliography of past and current studies. Current work on problems associated with developmental pressures at the urban-rural interface and integrated approaches to natural resource management have multiplied the value and benefit of the forest. For information contact: Judson Edeburn, Duke Forest Resource Manager, Room 206-A Biological Sciences Building, Duke University, Box 90332, Durham, North Carolina 27708-0332.

**Forestry Sciences Laboratory.** The Forestry Sciences Laboratory of the USDA Forest Service, Southeastern Forest Experiment Station is located in the Research Triangle Park near Durham. This research organization provides excellent opportunities to complement research conducted by students in the School of the Environment. Specialized research projects in timber investment opportunities, market efficiency, forest soils, insect toxicology, air pollution impacts, and the economics of forestry in developing countries are currently under way at the laboratory. The staff of the laboratory is available for consultation and participation in seminars. Arrangements may be made for students to conduct certain aspects of their research at the laboratory.

**Marine Laboratory.** The School of the Environment Marine Laboratory, an inter-departmental training and research facility of the university, is located on Pivers Island within the Outer Banks, adjacent to the historic seacoast town of Beaufort, North Carolina, with direct access to the Atlantic Ocean, Cape Lookout National Seashore Park, estuaries, sand beaches, wetlands, and coastal forests. Because of the dynamic collisions of offshore currents, the area provides an excellent opportunity for marine study and research. The laboratory accommodates nearly 3,700 visitors per year, including fifteen to twenty resident graduate students who are involved in year-round activities. (For additional information concerning the graduate program, refer to the section on marine sciences in the chapter "Courses of Instruction" in this bulletin and the current *Bulletin of Duke University: School of the Environment* and the *Marine Laboratory* 1994 publication.)



The physical plant consists of twenty-three buildings, including classroom laboratories, six research buildings, four dormitories, a maintenance complex, and a dining hall. The laboratory has skiffs, the R/V *Susan Hudson* training vessel with the capacity to perform small-scale biological, chemical, geological, and physical oceanography, and a 135-foot research and training vessel, the R/V *Cape Hatteras*, which is operated by the Duke/UNC Oceanographic Consortium.

For information concerning teaching and research space, write to the Personnel and Auxiliaries Office, Duke University School of the Environment, Marine Laboratory, Beaufort, North Carolina 28516-9721.

**Zoology Field Station.** The Zoology Field Station, located less than one mile from campus, provides facilities for the study of penned, free-ranging, and caged animals in a protected wooded area of eighty acres with two ponds. For information regarding research space, write to the Chairman, Department of Zoology, Duke University, Durham, North Carolina 27706.

**Primate Center.** The Duke University Primate Center is located in Duke Forest about two miles from the main campus. The colony is composed of approximately 550 prosimian primates representing thirteen genera, twenty-two species, and twenty-eight sub-species. This is both the largest and most diversified colony of living lower primates in the world and the world's largest conservation center for primates. The center also houses frozen, preserved, and fossil primate collections. These collections and animals are utilized by faculty members and both graduate and undergraduate students in the Departments of Biological Anthropology and Anatomy, Environment, Geology, Psychology, and Zoology for all qualified research in primate paleontology, prosimian aging, locomotion, cytogenetics, comparative anatomy, behavior, and physiology. Applications for graduate study in one of these areas should be directed to the director of graduate studies of any of the five departments. For information pertaining to the use of the Primate Center, graduate studies, or availability of research space, write to Dr. Kenneth E. Glander, Director, Duke University Primate Center, 3705 Erwin Road, Durham, North Carolina 27705.

**Animal Care and Use Program.** The animal care and use program serves the research and teaching programs of Duke University. The program is centrally managed by laboratory animal veterinarians in the Division of Laboratory Animal Resources (DLAR). DLAR maintains a central vivarium, satellite facilities and a farm where laboratory animals are housed. The institutional animal care and use committee monitors the program to ensure the humane care and treatment of animals. Duke University is registered with the United States Department of Agriculture and is fully accredited by the American Association for the Accreditation of Laboratory Animal Care (AAALAC), which assures compliance with standards of NIH.

**Experimental Psychology Laboratories.** The facilities of the Department of Psychology: Experimental include laboratories to study human memory, perception and cognition in children and adults, classical and operant conditioning in various species, maze learning, and taste and smell in animals and people. There are facilities for animal surgery, autoradiography, photographic darkrooms, histology, and psychophysiology to help relate vision, taste, and smell to brain aspects and to learning, memory, emotion, and development. There also are sound and speech processing capabilities, labs for visual observation of infant's and young children's social interactions, and various facilities for computational modeling. General purpose laboratories are well supplied with computers for various uses. To facilitate new projects, there are woodworking, metalworking, and electronic shop facilities staffed by full-time technicians. Additional facilities are available in the nearby Primate Center and the Duke and V.A. Medical Centers, as well as in area universities and in research companies in the Research Triangle Park.

**Chemistry Laboratories.** The Department of Chemistry is housed in the Paul M. Gross Chemical Laboratory, a building containing 146,000 square feet of total area. This well-equipped chemical laboratory provides conditions conducive to research in many areas of current interest. Nuclear magnetic resonance facilities include a broad band Varian XL-300, General Electric QE-300, G-300 (25 mm wide bore probe) and GN-500 frequency adjustable instruments, a JEOL FX-90Q, and two 60MHz proton instruments. An ESR spectrometer, the Varian E-9, provides an excellent facility for research in electron spin resonance. Mass spectrometric service is provided by a Hewlett-Packard GC-MS system with HPLC/MS capacity, as well as access to a VG-70S high resolution MS with MS/MS capability. X-ray diffraction cameras of all types are available, along with Enraf-Nonius CAD-3 and CAD-4 automatic diffractometers. Numerous instruments of varying sophistication for photoacoustic, fluorescence, infrared, routine FTIR, dispersive infrared, UV, Raman and ORD-CD spectroscopy are available; various laser sources, monochromators, and computerized data acquisition systems are associated with these systems. Some other significant research facilities include T-jump, stopped flow and diode array spectrometers for rapid kinetic studies, a circularly polarized luminescence spectrometer, and an ultra dry lab facility. A variety of preparative and analytical gas and liquid chromatographs are also located in the building and a number of analytical applications of robotic systems are employed. Research in biological chemistry is facilitated by the availability of an autoclave, media prep room, high speed centrifuges, and ultra centrifuges.

Computing facilities in the Department of Chemistry include a VAX 8350 with an associated tape drive and two 456 megabyte Winchester mass storage devices which operate in a multiuser FORTRAN environment. An Evans and Sutherland PS 390 and Tektronics graphics terminals are connected to the system as well as a cluster of DEC terminals. Clusters of Apple Macintosh, IBM, and AT&T PCs, and Sun workstations are also available. The departmental VAX system and many other computers associated with specific research groups are networked via Ethernet, which is linked to the university fiber optic network. Among the resources available via the network are Duke's IBM 4381 mainframe and the North Carolina Supercomputer Center's Cray Y-MP 8/432.

The department has a machine shop and an electronics shop, and has access to the university glass-blowing shop. The facilities of the Duke University Marine Laboratory on the coast at Beaufort, North Carolina, are available for specimen collecting and processing studies of organic chemicals of marine origin. The Department of Chemistry Library, with holdings of approximately 45,000 volumes, is also located in the Paul M. Gross Chemical Laboratory. The library receives 375 current scientific periodicals, 275 serial subscriptions and has a computer facilities for complete information retrieval.

**Physics Laboratories.** The Physics Building houses research and instruction in the Departments of Physics and Mathematics. Additional space is provided by the adjacent Nuclear Building (TUNL) and Free Electron Laser (FEL) Laboratory Buildings. Graduate students studying in these two departments usually have offices in these buildings.

About half of the physics space is devoted to research laboratories for the department's programs. Special equipment includes: picosecond, dye, carbon dioxide, and far infrared lasers; a 45-MeV electron linear accelerator driving an infrared free electron laser (FEL) and a 1 GeV linear accelerator and high current electron storage ring driving an ultraviolet to soft X-ray FEL; a high-resolution 4 MeV Van de Graaff accelerator; a 20 MeV tandem Van de Graaff accelerator with polarized source and cryogenically-cooled polarized targets; a helium liquefier, cryostats, magnets, and associated equipment for research in the millikelvin temperature range; VAX computers for data collection and processing in nuclear physics and in high-energy physics; various minicomputers and microcomputers in the research groups; a cluster of seven NeXT computers for instructional/research use; and a Sun minicomputer for general departmental use.



The Mathematics-Physics Library is located in the Physics Building; it contains a large selection of books and scholarly periodicals. Also located in the building are appropriately staffed instrument and electronics shops.

**Engineering Research Laboratories.** The laboratories of the four departments of the School of Engineering contain extensive basic equipment that may be applied in several specialized fields. The facilities available for instruction and research are suggested by the following brief listing of equipment found in each department:

*Biomedical Engineering.* Biomechanics laboratories: hydraulic testing system, IBM PS/2 microcomputer, micro VAX II computer, optical displacement measuring system, silicon graphics/GE graphcon system, Sun micro systems SPARC station, Zonic modal analyzer. Biomedical materials and surface interactions laboratories: air- and water-cooled Argon lasers, air convection oven, capillary rheometer, FTIR infrared spectrometer, gamma counter, gel permeation chromatograph, Langmuir-Blodgett trough, liquid nitrogen cooled CCD camera, Nikon inverted microscope with phase contrast and epifluorescence, Ulimage image analysis system and Macintosh II, vacuum oven, Zeiss axioplan microscope, electrophysiology and neurophysiology instrumentation. Ultrasound imaging and transducer laboratories; CAD/CAM stations for circuit development, diamond tip dicing saw, high-speed video system, image processing system, laminar flow hood, multiple PCs and work station, PC board maker, ultrasound mechanical scanner, VAX 11/780.

*Civil and Environmental Engineering.* Faculty in civil and environmental engineering routinely design, construct, and adapt laboratory equipment for specialized teaching and research tasks in engineering mechanics, environmental engineering, geomechanics, structural engineering, transportation and systems engineering, and water resources engineering. In addition, arrays of standard laboratory facilities are available to support each research area.

Research and teaching facilities in engineering mechanics, structural engineering, and geomechanics include four independent closed-loop electrohydraulic dynamic loading systems (MTS), with a frequency range up to 100 Hz, and ranges of load to capacity 6,000, 35,000, 50,000 and 220,000 lbs. The 6,000 lbs. actuator can develop a constant crosshead speed up to 50,000 in./min. For teaching and research, the department has a 10,000 lb. universal testing machine and a 10,000 lb. torsion machine both fully instrumented with computer data storage, as well as a Kistler force plate with 10 decades of sensitivity. Equipment is available for fabricating specimens and testing fiber-reinforced polymer composites. An environmental chamber tests in the temperature range of -100° to +350° F; equipment for spectral and modal dynamic analysis, and an ultra-high pressure triaxial shear apparatus is available for confining pressures up to 100,000 psi. Rock-testing facilities, model-testing equipment for anchored walls and penetrometer studies, a large-aperture research polariscope, a reflective photoelastic polariscope, and a sustained-loading facility for long duration in studies of prestressed concrete are routinely used in teaching and research procedures.

Research and teaching facilities in environmental engineering include wet and dry laboratories equipped to study a range of physical, chemical, and biological processes. A fully integrated resource recovery pilot plant, calorimetry for the measurement of heat values of secondary fuels, air classifiers interfaced with computer monitors, as well as indoor and outdoor water resources monitoring devices including flumes, Venturi meters, and digital computation hardware are available. The biotechnology and physical-chemical laboratories are equipped with autoclaves, a media preparation room, walk-in environmental rooms, numerous fume hoods, a biohazard containment facility for cultivation of genetically engineered microorganisms, fully instrumented bioreactors with on-line control, and various analytical instrumentation including liquid scintillation counting, autoradiography, atomic adsorption spectroscopy, total carbon analysis to ppb levels, gas chromatographs equipped with ECO, FID, and TCD detec-



tors, HPLCs, computer-assisted image analysis microscopes, and a recently acquired fourier transfer infrared spectrometer facility.

Computer resources available to civil and environmental engineering students include a multitude of personal computers, two Digital Equipment Corporation Workstation clusters consisting of fifty workstations in total. Additionally, the department houses and maintains its own computing facility, providing five UNIX workstations (1DEC, 1 SUN, and PC's with silicon graphics 486 processors) and 9 IBM-compatible PC's also with 486 processors. This particular facility is dedicated to graduate student research and special undergraduate projects. Most of the computer resources are networked with the School of Engineering's ethernet backbone and are easily accessible from several locations in the department and across the campus. Depending on the specific application, students can successfully investigate problems in computational fluid and solid mechanics, rigid-body dynamics, particle and mathematical optimization as well as transportation and environmental systems engineering research topics. If additional computing capabilities are needed, access to the Microelectronics Center of North Carolina's Cray YMP vector processing supercomputer is available. Numerous software packages are available to students through the existing Computational Resource Center. Many problems addressed by the faculty and students of the Department of Civil and Environmental Engineering are computationally complex and could not be approached without the substantial computing facilities available at Duke.

*Electrical Engineering.* General computing laboratory equipped with several IBM RS-6000s servers and a fast interconnect network in a UNIX environment for interactive design, graphics, computation, and computer-aided engineering; Sun SPARC workstations for VLSI design; ethernet network for connection to regional, national, and international data networks; Signal Processing Laboratory with Sun workstations; microwave facilities for experimentation up to 35 GHz; robotics with a GE P-50 robot; microprocessor laboratory; Digital Systems Laboratory; solid-state power conditioning laboratories with dedicated computers for controlling instruments, including digital processing oscilloscopes and network and impedance analyzers, and for computer-aided design; clean room and semiconductor nMOS fabrication laboratory for integrated circuits; a molecular beam epitaxy laboratory for III-V compound semiconductor crystal growth using a Riber Model 3R&D MBE system; access to the design, fabrication, and research facilities of the Microelectronics Center of North Carolina; and an ion implanter and MOCVD epitaxial growth system in a III-V compound semiconductor lab at the Research Triangle Institute.

*Mechanical Engineering and Materials Science.* The department has a number of well-equipped laboratories for studies in aerodynamics, acoustics, nonlinear dynamics and chaos, microscale and convective heat transfer, computational fluid mechanics and heat transfer, control theory, cell and membrane biomechanics, biorheology, polymer engineering, corrosion, electronic materials, physical metallurgy, positron annihilation spectroscopy, and expert systems. Equipment in these laboratories includes a wind tunnel, a scanning electron microscope, a scanning tunneling microscope, doppler broadening and lifetime positron systems, a liquid helium cryostat, DSC/DMA facilities and diffusion furnace, inverted microscopes, low-light-level video cameras and a photon counter, cell-culture systems, an anechoic chamber, a dynamic signal analyzer and laser velocimeter for bearing analysis, an X-ray generator and diffractometer, FTIR spectrometer, a high-power laser with lock-in amplifier, and a fluorescence microscope. A variety of computational equipment is available including a mini-supercomputer access to a regional supercomputer.

**F. G. Hall Hypo-Hyperbaric Center.** The F. G. Hall Hypo-Hyperbaric Center contains eight hyperbaric and/or hypobaric pressure chambers used to simulate altitude or deep-sea diving conditions, for the purpose of both experimentation and medical treatments. The interconnected steel chambers can simulate depths of 3,600 feet, or altitude of 155,000 feet, a capability unmatched in the United States. In 1982 a research

dive to 2,250 feet set a new world's record. Basic and applied research of this type has led to the development of safer and faster decompression methods, mechanisms of oxygen toxicity together with new treatments for diving accidents and diseases treated with high-pressure oxygen. The laboratory provides opportunities for research and for training for physicians, postdoctorates, and graduate students in pressure-related medicine and physiology. The program is multidisciplinary with major participation by the Departments of Anesthesiology, Medicine, Surgery, Cell Biology, Neurobiology, and the School of Engineering.

**The Medical Center.** Currently the Medical Center at Duke University occupies approximately 140 acres on the West Campus. The southern quadrant is contiguous with the main quadrangle of the university and consists of the following: Davison Building, Duke Hospital South, Baker House, Barnes Woodhall Building, Diagnostic and Treatment Building, Ewald W. Busse Building, Eugene A. Stead Building, Clinical Research II, and the Edwin A. Morris Clinical Cancer Research Building.

The northern portion includes the Joseph and Kathleen Bryan Research Building for Neurobiology, Nanaline H. Duke Medical Sciences Building, Alex H. Sands Medical Sciences Building, Edwin L. Jones Basic Cancer Research Building, Clinical and Research Laboratory Building, Bell Building, Seeley G. Mudd Communications Center and Library, Joseph A. C. Wadsworth Building (Eye Center), Duke Hospital North Division and Anlyan Tower, and Lenox Baker Hospital.

In the western section of the campus are: Surgical Oncology Research Building; Environmental Safety Building; Research Park Buildings I, II, III, and IV; the Vivarium; and the Cancer Center Isolation Facility.

In the eastern section of the campus are Pickens Rehabilitation Center, Civitan Mental Retardation and Child Development Center, and Trent Drive Hall.

*Student Life*

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## Living Accommodations

Duke University has two residential apartment facilities in which graduate and professional students live. These apartments are available for continuous occupancy throughout the calendar year. All of the apartments are completely furnished by the university. An itemization of furnishings is included with the floor plans sent out in the application bulletin. Spaces in apartments for single students are provided on an individual basis with each student paying rent per academic term to the university. This method permits students to share apartments with others of their choice. When this is impractical, the Department of Housing Management strives to place persons with similar interests together.

**Town House Apartments.** Town House Apartments, located about three blocks from the main East-West Campus bus line, is a thirty-two-unit complex. These apartments are more spacious than most apartments found on campus or in Durham. Because of its location away from the academic facilities, students find that it offers a change from normal campus life and activities.

Each air-conditioned apartment includes a living room, a master bedroom, a smaller bedroom, a bath and a half, and an all-electric kitchen with a dining area. Spacious closets and storage spaces are provided within each apartment. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months.

All utilities—water, heat, air-conditioning, gas, and electricity—are provided. Occupants must make arrangements with the local telephone company, GTE, to pay for telephone service. GTE usually requires a deposit when initial application for service is made. The company should be contacted prior to arrival as it usually takes several days to obtain service.

**Central Campus Apartments.** During 1975, Duke University completed a 500-unit apartment complex. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months. Additional facilities include a pub, convenience store, tennis courts, and basketball courts.

All utilities—water, heat, air-conditioning, and electricity—are provided. Telephone jacks are provided in each apartment. Duke University's Tel-Com supplies telephone

service. Central Campus Apartments residents are responsible for providing their own phones and having them connected.

Efficiency, two-bedroom, and three-bedroom apartments are rented to graduate students. Efficiency units are very limited in number and are generally not available to new students.

**Application Procedures.** When students are informed of their acceptance to Graduate School they will also receive a postcard on which to indicate preference for university housing. This postcard should be returned to the Department of Housing Management. Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. Assignment to all university housing is made on a first-apply, first-assigned basis, and it is not guaranteed.

**Off-campus Housing.** The Department of Housing Management maintains a listing of rental apartments, rooms, and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid students in their attempt to obtain housing off campus. Information on commercial apartment complexes in the Durham area may be obtained by indicating a preference for off-campus housing on the postcard which you will receive with your acceptance notice. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the University nor its agents negotiate between owners and interested parties.

The search for accommodations should begin as soon as possible after acceptance to the Graduate School. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the available facilities.

**Duke University Marine Laboratory.** The Duke University Marine Laboratory, located on Pivers Island, has cottage-type residence halls which are available. Further information may be obtained from the publication *Marine Laboratory 1994*.

## Dining Services

Graduate students are encouraged to dine on campus at any Duke Dining Services facility. Dining Services provides cafeterias, restaurants, fast food operations, delis, snack bars, ice cream/dessert shops, and catering services in convenient locations throughout campus.

On West Campus, students are invited to dine in the Blue & White Room (cafeteria), the University Room (cafeteria), the Oak Room (restaurant), the Cambridge Inn (deli, hot foods, salad bar, and dessert shop), the Rathskeller (hamburgers, pasta, and sandwiches), Burger King Cafe (fast foods), Lick's (ice cream/frozen yogurt), and The Café and The Perk (coffee bars), Sanford Institute Deli (sandwiches), LSRC Dining Room (hot foods, sandwiches, salad bar). On East Campus, visit the newly renovated East Food Court (a collection of food shops) and the Upper East Side (snack shop). North and Central Campus food service locations include Trent Cafe (grill, sandwiches, and desserts) and The Pub on Central Campus (specialty sandwiches, salads, and beverages).

Food purchases may be paid for any one of three ways: by using cash, a dining account, or a flexible spending account. Both the dining account and the flexible spending account allow a student to make purchases on campus by accessing a prepaid account carried on the student identification card, or DukeCard. Information about these DukeCard accounts is available from the Duke Card Office, 024 West Union Building, Box 90911, Durham, NC 27708-0911, (919) 684-5800.

Further information about campus dining service facilities and dining plan options is available from Duke Dining Services, 029 West Union Building, Box 90898, Durham, NC 27708-90898, (919) 660-3900.



## Services Available

**Student Health Program.** The Duke Student Health Program is administered by the Department of Community and Family Medicine, Duke University Medical Center. Medical services are provided by family physician faculty, physician assistants, and nurse-practitioners.

*The Duke Family Medicine Center (684-3180)*, located on the corner of Erwin Road and Trent Drive, is the primary location for medical care. Students are seen by appointment Monday-Friday, 8:00 A.M.-7:30 P.M., Saturdays from 10:00 A.M.-1:30 P.M., and Sundays from 2:00 P.M.-4:30 P.M. A wide variety of services are available: medical care, GYN clinic, health education, sports medicine, laboratory, pharmacy, travel and immunization, x-rays, cold/flu self-help table, allergy clinic, and nutrition counseling.

Students are encouraged to use the Duke Family Medicine Center as their portal of entry to other health resources when needed, including the specialty clinics at Duke University Medical Center. This will help with coordination of appropriate care.

**For problems arising after hours, students should call the Infirmary (684-3367).** After consulting with the physician on call, the nurse may advise the student to come to the Infirmary or to the Duke Emergency Department (684-2413) for further evaluation. In the event of an obvious life-threatening emergency, students should go directly to the Emergency Department. If necessary, Duke Public Safety (call 911 or 684-2444) will provide on-campus transportation to the Emergency Department or the Infirmary.

*The Infirmary (684-3367)*, located on the fourth floor of Duke University Hospital-South Division, Purple Zone, provides inpatient treatment of illnesses too severe to manage in the residence hall or apartment, but not requiring hospitalization.

The *Health Education* component of Student Health is headquartered at the Trent Drive Hall (684-3620, ext. 325). Health education staff are available, by appointment, to assist students in making informed decisions that promote their health. Topics of concern include alcohol and other drug usage, eating and nutrition, sexually transmitted diseases, stress management, and others. Health education staff are also available on a drop-in basis at the Healthy Devil Health Education Center, Room 113, House 0 in Kilgo quad on West Campus. Free, confidential pregnancy testing and pregnancy options counseling is also available there, by appointment (684-3620, ext. 325).

**Sports Medicine Services:** The Student Sports Clinic is located on West Campus, in the basement of Card Gym. A physical therapist is available from 3:00-6:00 P.M. weekdays, on a walk-in basis, to assess exercise-related problems, and to outline short-term treatment plans to aid recovery, and help prevent reinjury. The Sports Medicine Clinic is located on the third floor of the Finch-Yeager Building adjacent to Wallace Wade Stadium. There students may be seen by a Student Health physician, by appointment (684-6721).

**Counseling and Psychological Services (CAPS; 660-1000)**, is a complementary service to the Student Health Program. Mental health and career counseling services are available, as detailed in the CAPS brochure.

**Confidentiality.** Information regarding the physical or mental health of students is confidential, released only with the student's permission.

**Health Fee.** All currently enrolled full-time students and part-time degree candidates are assessed a Student Health Fee. This covers most services rendered within the Student Health Program (see below) during each enrolled semester. An optional Summer Health Fee for students not enrolled in summer session is also available through the Bursar's Office.

Health insurance is essential to protect against the high cost of unexpected illnesses or injuries which would require hospitalization, surgery, or the services of specialists outside the Student Health Program. All students are strongly encouraged to be certain that they have such insurance. For those not adequately covered by other insurance, the Duke Student Insurance Plan is specifically designed to complement the coverage

provided by the Student Health Fee. Coverage for the student's spouse and dependent children may also be purchased. Further information about this plan may be obtained from the Student Insurance Office (684-6455) or from Hill, Chesson, and Associates (489-7426).

**Services Covered by the Health Fee.** The health fee covers most of the services at Duke Family Medicine Center if medically indicated and rendered by a student health provider:

- Medical care for acute and chronic illness, and minor injuries;
- One annual health maintenance examination and associated studies;
- Routine laboratory and X-ray services;
- Medications on the approved formulary, as required for short-term treatment of nonchronic conditions;
- Immunizations required for programs receiving academic credit at Duke (a supplemental fee may be required for certain immunizations), excluding pre-matriculation immunizations.

The health fee covers a variety of other services at Duke Family Medicine Center and other locations:

- Health education and health promotion including nutrition consultation;
- Sports medicine, excluding specialists' (orthopaedic) services;
- Infirmary service, excluding meals and diagnostic testing order by specialist consultants;
- Mental health and career counseling at CAPS.

**Services not Covered by the Health Fee.** If you unsure whether a service is covered, please ask one of the Student Health staff prior to receiving service. You are financially responsible for the following:

- Medical care provided in the Emergency Department, hospital, or other non-student health facility;
- Dental care;
- Pregnancy care or deliveries;
- Tests, procedures, prescriptions not medically indicated or ordered by non-Student Health providers, or not on the approved list of services provided;
- Immunizations required for entrance to Duke or other universities, or for personal travel,
- Medications required for long-term use and contraceptives.

Upon arrival on campus, all students receive a detailed brochure about the program and the services covered by the Student Health Fee.

**Career Development Center.** The mission of the Career Development Center is to educate the students of Duke University in the arts of self-assessment, career exploration, career planning, and job hunting with the goal of helping them develop rewarding and fulfilling careers. The center primarily serves the students and alumni of Trinity College, the School of Engineering, and the Graduate School.

Career counselors are on staff to help students at Duke begin the process of discovering career interests. The career specialist for graduate student concerns provides specific information and advice to graduate students interested in pursuing academic and alternative professional careers. Other career specialists help students focus on specific career fields, including the arts, business, community service, education, engineering, mathematics, computer science and the physical sciences, government, health and life sciences, higher education, international careers, and mass media.

Programs and services of the center include the credential service, which collects and sends letters of recommendation, the video interviewing program which offers interview training, the on-campus recruiting program offering interviews for permanent positions with a wide variety of national organizations, and DukeSource providing access to alumni / ae advisors in a wide variety of academic disciplines and career fields.



*The Career Spectrum*, a weekly career page in Monday's *Duke Chronicle*, is designed to keep students aware of current career-related opportunities on- and off-campus. Announcements of job openings, career seminars, workshops, and information sessions also appear each month in a CSC newsletter mailed to graduate departments. The Career Library and Job Room provide a wealth of printed and database materials on specific career fields and specific employers. CareerNet, an online career information system, provides information at computer clusters located throughout the university and is available until midnight on weekdays and twenty-four hours a day over the weekends. Using CareerNet, a student may review bulletins, information about the center, review summer and full-time job listings, and register to participate in center programs.

**The Office of Continuing Education** also offers career development services, with both individual consultations and group workshops. The office provides help with resume preparation and offers guidance tests, including the Myers-Briggs Type Indicator, a test of personality preferences that allows students to better understand their own personalities, gain insight into differences they experience with others, and begin to look at career fields that fit their personality preferences. The office does charge a fee for these services. For more information, please call 684-6259.

## Student Affairs

**Cocurricular Activities.** Graduate students at Duke University are welcome to use such university recreational facilities as swimming pools, tennis courts, the golf course, and to affiliate with the choral, dance, drama, music, and religious groups. They may become junior members of the American Association of University Professors and may affiliate with Phi Beta Kappa and social fraternities.

A full program of cultural, recreational, and religious activities is presented by the Office of Cultural Affairs, the Duke University Campus Ministry, the Duke University Union, the Office of Student Activities, and recreational clubs. The Duke University Union sponsors a wide range of programs through its committees, which are open to all segments of the campus community. Included are touring Broadway shows; rock, jazz, and pop concerts; speakers; films; a film-making program; the largest fully student-run television station in the country; art exhibits in three galleries; and a broad program in crafts located in Southgate Dormitory and the Bryan University Center. The Aquatic Center and the East Campus Gymnasium pool are available to students, faculty, and staff families. The handball, racquetball, squash, and tennis facilities and the weight room on East and West Campus are also available. Interested students may participate in softball and other team sports.

The University Center complex includes the Bryan University Center, which houses the Information Center, two drama theaters, a film theater, lounges, stores, meeting rooms, games room, the Rathskeller, art gallery, and other facilities; the West Union, which includes dining facilities; and Flowers Building, which includes student publications, Page Auditorium, and the university box office.

Inquiries should be directed to the Recreation Office, 105 Card Gymnasium; the Office of Cultural Affairs, 109 Page Building; Duke Chapel; the Duke University Union, Bryan University Center; or the Office of Student Activities, Bryan University Center.

Full information regarding the scheduling of major events and programs for the entire year will be found in the *Duke University Yearly Calendar*; detailed and updated information for the fall and spring semesters in the *Duke Dialogue*, available each Friday; updated information for the summer session in the *Summer Session Calendar*, published at the beginning of each summer term; and the *Duke Chronicle*, published each Monday through Friday during the fall and spring and each Thursday during the summer. Copies of the Duke University calendars may be obtained at the information desk, Bryan University Center, or the calendar office, Page Building. Also during the summer, the

*Summer Session Calendar* is published weekly by the summer session office and is available at convenient locations.

**Graduate and Professional Student Council.** The Graduate and Professional Student Council is the representative body for the students of graduate departments and professional schools. The council provides a means of communication between schools and between graduate students and the administration. The council selects graduate students for membership on university committees. Representatives of each department and officers of the council are selected annually.

**Religious Life.** The Duke University Chapel, open from 8:00 A.M. until 10:00 P.M., provides a magnificent setting for daily prayer and meditation. In addition, a variety of worship experiences are provided throughout the week including the university service of worship at 11:00 A.M. each Sunday, noonday prayer each weekday during term, and choral vespers each Thursday at 5:15 P.M. The one hundred and fifty-voice Chapel Choir is open by audition to all interested singers. The Graduate and Professional Student Fellowship, sponsored by Duke Chapel, provides ecumenical fellowship as well as service opportunities for interested students. Duke Campus Ministry also invites graduate students to participate in the various religious life groups. Contact the Office of Dean of the Chapel or the Assistant Dean of the Chapel, Duke Chapel, for further details.

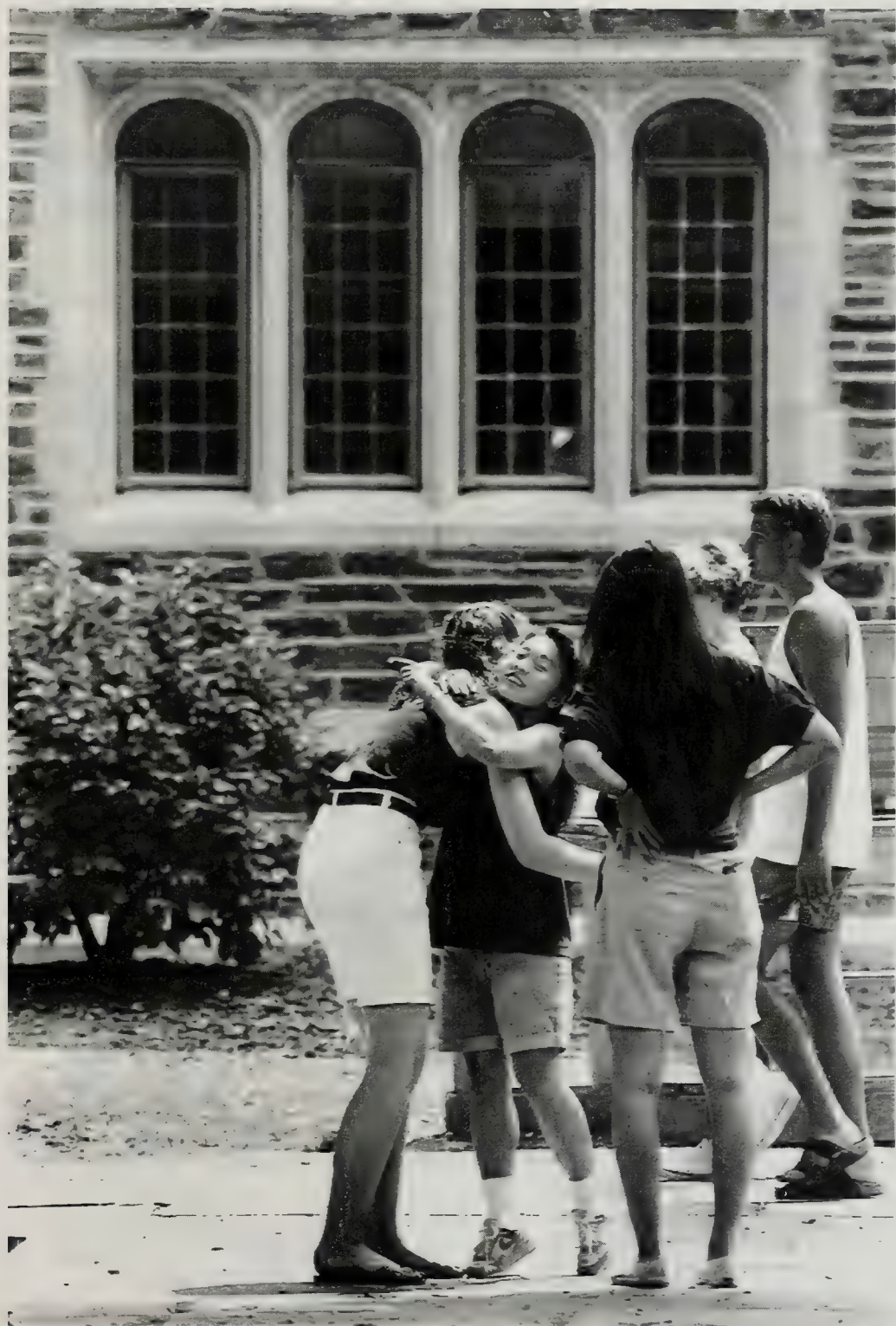
## Visiting Scholars

The libraries and other facilities of Duke University are made available, to the extent practicable, to faculty members of other colleges and universities who wish to pursue their scholarly interests on the Duke campus. Such visitors are not charged unless they wish to participate in activities for which a special fee is assessed. Inquiries pertaining to visiting scholars should be addressed to the department chairman concerned or the dean of the Graduate School.

## Postdoctoral Research

Scholars engaged in postdoctoral research often find it advantageous to use the resources of Duke University during the summer. The university welcomes these visitors and makes living accommodations available to them during the summer sessions from May 9 to August 8. Persons desiring research privileges (library and/or laboratory) should request approval through the department in which the research interests lie or through the Graduate School.









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